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Applicability of Using Native Plant Species for Highway Planting in Utah

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APPLICABILITY OF USING NATIVE PLANT SPECIES FOR HIGHWAY PLANTING IN UTAH

by

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A thesis submitted in partial fulfillment
of the requirements for the degree

of

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Approved:

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Richard Llewellyn Carlson

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Species for Highway Planting

in Utah

by

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This study had two goals: first, to establish a need to use native plant materials for planting and revegetation of highway right-of-ways in Utah; and secondly, to develop a list of potential native plants suitable for highway planting in Utah.

To accomplish these two goals, three steps were completed. Correspondence was exchanged with officials of other state highway departments to determine their attitudes concerning the use of native plants for highway planting. Second, a case study was completed on two sections of the Interstate Highway system in the Weber-Davis area of Utah. This was done to document the present planting practices of the Utah Department of Transportation. The survival rate of the plants planted by Utah Department of Transportation was determined to be moderate to low, while native species have revegetated and were surviving without special maintenance. It was determined that there

was a need to utilize native plants for highway planting in Utah. Third, a list of native plants was developed to provide a potential list of species suitable for highway planting and revegetation.

(209 pages)

CHAPTER I

INTRODUCTION

General Introduction

The plant materials that are being used in landscape designs for highways in the State of Utah are mainly nonindigenous species. A typical plant list for a planting design along Interstate Fifteen would include:

1. Russian Olive *Elaeagnus angustifolia*
2. Green Ash *Fraxinus pennsylvanica lanceolota*
3. Thornless Honeylocust *Gleditsia triacanthos inermis*
4. Canaert Juniper *Juniperus virginiana canaertii*
5. Golden Rain Tree *Koelreuteria paniculata*
6. Austrian Pine *Pinus nigra*
7. London Plane Tree *Platanus acerifolia*
8. Carolina Poplar *Populus canadensis*
9. Moline Elm *Ulmus americana moline*
10. Pfitzer Juniper *Juniperus chinensis pfitzeriana*
11. Smooth Sumac *Rhus glabra*
12. Wheatgrass *Agropyron* spp.

These plantings must be irrigated and given intensive maintenance if they are to survive. These activities are costly both in dollars and in limited water resource. Consequently, the size and number of areas which receive intensive planting are reduced. Use of native plant

material has not been extensively explored for Utah highways. Jonathan Palmer (1976) a landscape architect for the Utah Department of Transporation, stated that due to the problem of an inadequate supply of native nursery stock and seed, no comprehensive studies have been undertaken to identify native plant material that would be suitable for highway planting in various life zones of Utah. Although there have been some experimental uses of native plants, these studies have been mainly limited to grasses for quick erosion control.

Purpose of the Study

The purpose of this thesis was to examine the applicability of using native plant materials for the planting of highway right-of-ways. Secondary purposes include the development of a list of native plants suitable for highway planting in Utah, and the consolidation of known information regarding these plants.

Objectives

To achieve the purposes of this study, the following objectives were established:

1. To determine what various planting design authorities have stated concerning the use of native plant materials for highway planting;

2. To determine if the highway design departments of Arizona, New Mexico, Colorado, Wyoming, Idaho and Nevada (the states surrounding Utah) have used native plant materials for their highway planting;

3. To discuss what factors and conditions influence plant survivability in the highway environment;

4. To complete a case study on a predetermined section of highway which would include a description of the environmental characteristics of the site and an evaluation of the plant material existing on the site, both planted by UDOT (Utah Department of Transportation) and naturally occurring;

5. To select a list of native plants for use as an alternative to the exotic species presently being used;

a. An information sheet for each suitable species would consolidate known information regarding that plant,

b. A matrix summarizing the pertinent information on each species would be developed.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

The Review of Literature serves two purposes. Part one, "The Use of Native Plant Material for Highway Planting," includes comments by various authors and highway personnel from states bordering Utah concerning the use of native plants for highway planting. This review provides a perspective on the subject and a look at the state of the art.

Part two, "Considerations for Choosing Plant Materials for Highway Landscaping," reviews factors critical to the survival of plants in the environment. This section includes information on climatic zones in Utah, macroclimate, microclimate and soils. The section also reviews AASHTO (American Association of State Highway Transportation Officials) standards for highway plantings. This information is necessary to define the environmental and maintenance criteria necessary in selecting the proper native plants for a particular site.

The Use of Native Plant Materials for Highway Planting

The concept of highway landscaping being promoted by ASSHTO was published in their book A Policy on Design of Urban Highways and

Arterial Streets (1973). The policy stated that there should be appropriate standards set forth for the development of highway landscaping and erosion control for roads and roadside areas. An important point was that "Landscaping should not be considered as a cosmetic treatment to be applied after the construction phase is completed," (AASHTO, 1973, p. 403) but that the appearance of the highway and the impact that it would have on the environment should be kept in constant focus throughout the design process.

Sylvia Crowe, in her book, The Landscape of Roads, states that:

> The road-landscape should be an intensification and simplification of the surrounding landscape, and should serve to bring it in an unbroken flow up to the line of the road, without the interpolation of a third element and without the harsh lines of earthworks or parallel curtilage fences. (Crowe, 1960, p. 132)

To achieve a "natural" appearance for roadways, AASHTO officials suggest that vines, ground cover, shrubs and trees should be used to soften the hard lines and scars created by the construction of highways. The plant material

> Should be of types native to the area and located in natural groups rather than on formal geometric lines. Extensive roadside areas of uniform width and without trees, shrubs or other plants are very unattractive and monotonous. Instead, designs should provide for variation in the clear roadside through the use of appropriate shrubs and trees. (AASHTO, 1973, p. 403-404.) (Emphasis added)

Sylvia Crowe, further elaborates on the use of native plant materials by stating that:

> The goal of bringing the landscape as close as possible to the essential boundary of the road means that the planting should consist, wherever possible, of local species grouped in the local plant communities, although the groupings and open spaces will be larger, to adapt them to the speed-scale. (Crowe, 1960, p. 113)

Through all of her discussions Crowe emphasizes the need to group plants into plant communities, with the proper associations.

> Trees are sometimes found in pure stand and occasionally look best in this way, like a pure beech wood; but they are often in mixture, associated with an undergrowth of shrubs, and they almost always have some form of plant life forming the forest floor. The establishment of these complete plant communities make roadside planting more interesting and, at the same time, link it far more closely with the surrounding landscape. It is also easier to establish natural groupings than individual trees. The casual mingling of the local shrub species along the autobahns makes a far better and more unified pattern than the pure stands of one species after another. (Crowe, 1960, p. 114.)

Tunnard and Pushkarev also point out a need for plant communities as part of the right-of-way in Man-Made America.

> While shoulders, medians, and drainage areas have to be closely cropped, the native plant communities should be allowed to perpetuate or establish themselves on the remaining parts of the right-of-way, . . . saving on maintenance cost . . . In building up indigenous plant communities, the changes conditions have naturally to be taken into account. Quite often it can happen that trees carefully protected from heavy construction equipment have died because excavation lowered the water table or because their roots became exposed. Thus the goal should always be restoration of natural conditions, but within a new, man-made framework. (Tunnard and Pushkarev, 1963, p. 230.)

An early implementation of erosion control is a necessity along highway roadsides. This protection is essential to prevent soil from being washed into storm sewers or silting highway ditches and natural drainageways (AASHTO, 1970, p. 14-17). On the subject of using plants for erosion control, White states,

> It has long been recognized that highway construction scars must be healed and that soil erosion must be controlled, if only for practical reasons. Turf used to be the universal answer, and it will always play a significant role in the development and

> stabilization of the roadside. But with more modern concepts of highway engineering and landscaping, we must make use of other plant materials to solve the many problems that now confront the highway commissions, the highway user, and the individual whose property abuts on the highway. (Brewster, 1959, p. 113)

Maintenance is an important consideration in determining an effective and economical design for roadside landscaping. Because of the high cost of maintaining extensive lengths of highways, the maintenance of plant material is often neglected. Turf is widely used as alternative to ground cover, shrubs and trees in highway landscaping because of its low initial installation costs.

> . . . . maintaining grass areas in some regions should be weighed against the higher initial cost of planting and establishing long-lived, low-growing types of vegetation to eliminate continuous and repeated moving of turf. (AASHTO, 1970, p. 34)

White also discussed alternatives to the use of turf.

> The most general reason given for not using other plants more extensively in developing the roadside is an alleged increase in maintenance costs. This need not be so if proper planning is done. Wise planting can reduce the annual maintenance cost to as near zero as it is possible to achieve . . . . trees and shrubs can be used in mass naturalistic plantings. Once established, they require only a minimum of maintenance. Such planted areas do not even need mowing. (Brewster, 1959, p. 117)

Although native plant materials have been suggested for the use of highway landscaping, it is not always feasible to do so. Crowe states:

> Almost the only exception to the use of local species is where plants are required for some particular purpose, or to grow in conditions under which local plants would not thrive. In these cases the introductions should be chosen to accord with the local character. Sometimes a species, which is normally associated with the type of country, is absent, and may be introduced. For instance, the native Genistas may be used in a sandy district for colonizing

> embankments, or willows for planting a damp roadside waste. (Crowe, 1960, p. 113.)

Utilization of Native Plants by Highway Departments of States Surrounding Utah

A questionnaire letter was mailed to highway design departments of the surrounding states of Arizona, New Mexico, Colorado, Wyoming, Idaho and Nevada to determine if native plant materials have been used for their highway plantings. (See Appendix A.)

Of the six letters sent, only the Colorado Department of Transportation failed to respond. The five other states provided information pertaining to the use of native plants in their highway plantings.

The Nevada Department of Highways stated that,

> Becuase of our very low annual precipitation and the lack of a commercial source of native plant material, we have planted only grasses for erosion control on our open roadway sites. (State of Nevada, 1976) (Emphasis added.)

The Arizona Department of Transportation related that they have, and still do, use indigenous plants for highway landscaping, but feel that "indigenous plants require as much or more maintenance as introduced ones." (State of Arizona, 1976)

Information pertaining to the use of indigenous plants for landscaping in Arizona has been compiled by the Natural Vegetation Committee Arizona Chapter, Soil Conservation Society of America (Landscaping with Native Arizona Plants). Nevada also has information regarding the appropriate trees, shrubs, and grasses for highway planting (Review of Highway Planting Information Appropriate to Nevada)

by N. Stark, (1966) but did not refer to the publication in their correspondence.

The states of Idaho, Wyoming, and New Mexico all stated that they utilize native grasses and shrubs for landscape designs.

The New Mexico State Highway Department related that,

> In 1965, the Department entered into a cooperative agreement with the Soil Conservation Service for the purpose of developing plant species selections, and evaluation of these plants for adaptability, growing characteristics, propagation methods, and establishment techniques. Through this effort we have utilized thousands of "native" plants in both dry land and irrigated plantings. (State of New Mexico, 1976.)

The Idaho and Wyoming State Highway Departments also stated that they use native seed in their mixes for highway planting. As yet, this type of planting and research has not been undertaken in Utah-nor has it apparently been considered.

Considerations for Choosing Plant Material for Highway Planting

There is more to highway landscaping than the choosing and placing of plants along the right-of-ways of highway systems. Often a plant will fail where it is felt that it should survive because of particular unfavorable environmental factors. Environment is the combination of external or extrinsic conditions that affect the growth and development of the plant. Along highways, many different ecological factors such as soil, temperature, precipitation, elevation and exposure exist which influence the growth of plants. Other factors, such as road construction, maintenance, highway standards and specifications for planting all influence the survivability of plants.

It is the purpose of this section to discuss what these factors are, and how they effect the growth and survivability of the plants. This section is not intended to be an intensive discussion of each topic. Rather it serves as a check list of essential considerations. The assumption is made that detailed site investigations of each topic for any given highway project would be required.

Climate Zones

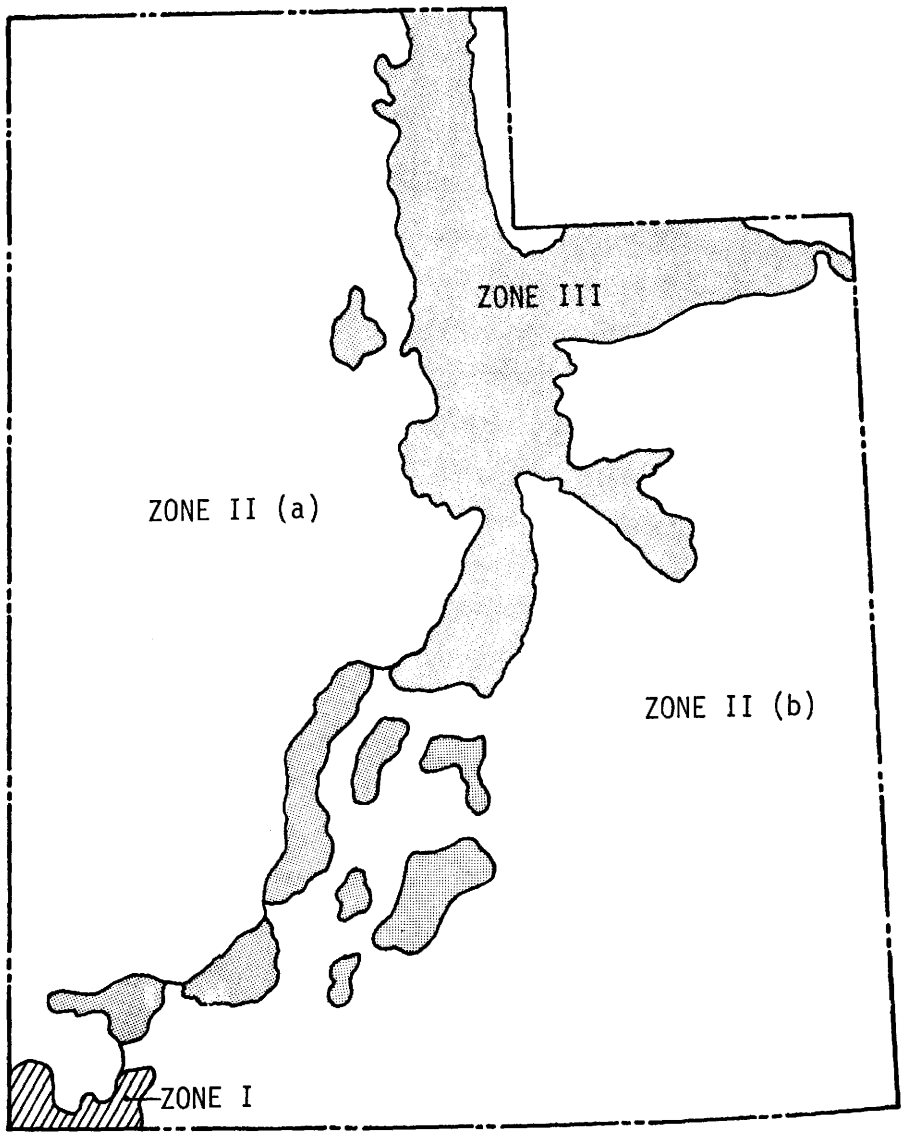
In Utah there are three basic climatic zones, based on elevation and physiographic relief. Zone I is the portion of the Sonoran Desert which is located in the lower southwest region of the state. Zone II consists of the Great Basin on the western portion of the state, and parts of the Colorado Plateau on the eastern portion of the state. Zone III is the mountainous region which bisects the state. A map (Figure 1) of these climatic zones was developed from Kuchler (1964).

Each region has its own unique soils and climate. Within these three larger climatic zones are subzones or regions which are created by specific features of microclimate, soil, vegetation, and topographical characteristics.

The following is a brief description of the regions which exist in these three zones (Hunt, 1967 and Smith, 1974).

Zone I

The Sonoran desert is known for its richly diversified vegetation of shrubs, trees and succulent cacti. The Sonoran desert has a richer variety of ephemerals than any other desert. Many of these and other



ZONE I Sonoran Desert

ZONE II (a) Great Basin
(b) Colorado Plateau

ZONE III Mountainous Region

Figure 1. Three climatic zones of Utah

small plants grow in close association about the base of larger trees. The Sonoran Desert is characterized by hot dry weather with an annual precipitation of ten inches. The topography includes valleys, foothills and mountains rising to 3,500 feet above sea level. The transitional area between the Great Basin and the Sonoran Desert has the simplest composition of vegetation and also contains species common to the Great Basin. The characterizing shrubs and grasses include Blackbrush, Creosotebush, Joshua Tree, Red Brome and Galleta Grass.

Zone II

Great Basin. The Great Basin is a cold desert. Its precipitation ranges from nine inches in the salt-desert areas to thirteen inches in the Pinyon-Juniper forests. Most of the moisture in the Great Basin comes in the form of snow during the winter. The longest frost-free period is more than 120 days. Sagebrush is the dominant plant of the cold desert. Also found are Saltbrush, Shadscale, Hop Sage, Winterfat and Greasewood. Elevations range from 5,000 to 6,000 feet above sea level.

Colorado Plateau. The Colorado Plateau is comprised of the Uinta Basin, the Canyon Lands and the High Plateaus. The Colorado Plateau has a saucer like form. This physical structure is reflected in the climate of the area. Precipitation is greater and the evaporation rate lower along the rims than in the interior of the plateau. The annual precipitation ranges from 10 to 20 inches. The plateau is generally arid because of the high evaporation rate. Effective moisture is low because during the growing season, close to 95 percent

of the precipitation is lost by evaporation, transpiration and seepage into the ground. Summers are hot and winters are cold and the number of frost free days varies from 200 days to 100 days or less.

The Colorado Plateau vegetation also reflects the saucer-shaped form of the plateau surface. The plateau rims and isolated mountains are forested with pinyon and juniper, while the interior supports desert shrubs or grasslands of Sagebrush, Shadscale, Blackbrush, Grama and Curly Grass.

Zone III

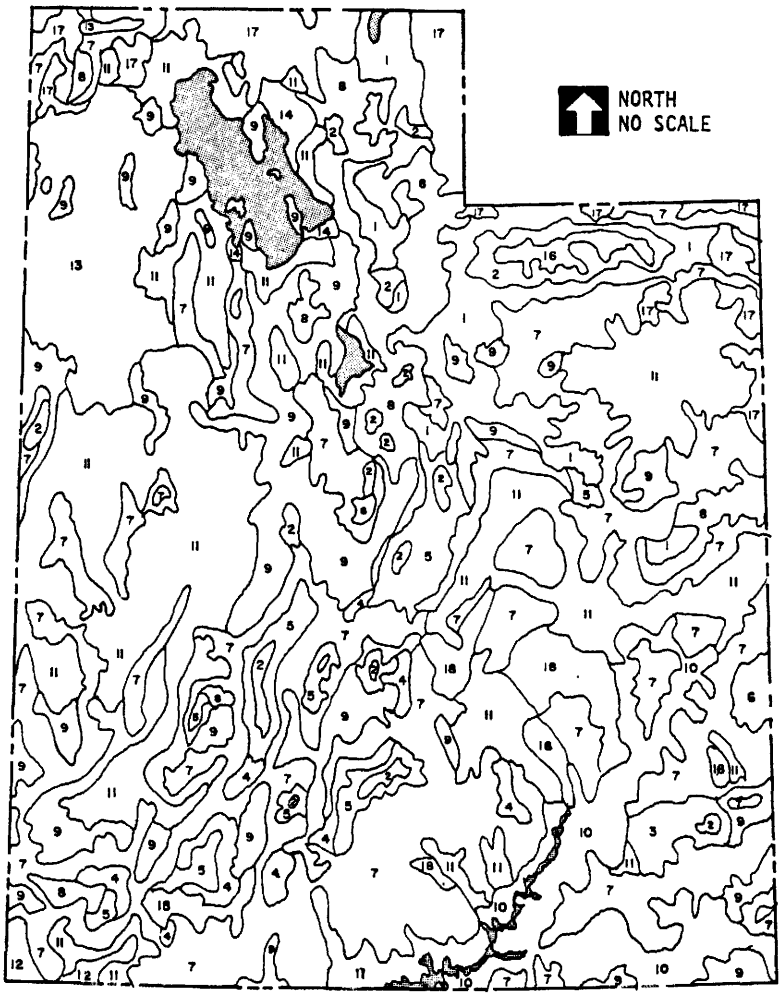
The Mountain zone consists of several regions, Alpine, Subalpine, Montane and Transition, which are determined by elevations and vegetation types. The Transition area between the Great Basin-Colorado Plateau zone and the Mountain zone is comprised of valleys and foothills. Its elevation is 7,500 feet above sea level. Plants which characterize this area are Gambel Oak, Bigtooth Maple, Black Chokecherry and Serviceberry. Average annual precipitation is sixteen inches. The elevation on the montane area is 8,500 feet above sea level. The predominate plants are Aspen, Fir, Mountain Snowberry, Slender Wheatgrass, Mountain Brome, and Sticky Geranium. The average precipitation is twenty-five inches.

Higher elevations of the zone consist of the Subalpine and Alpine regions. The elevation of the Subalpine averages 9,800 to 10,800 feet above sea level. The predominate plants of the Subalpine are Spruce, Fir, Redberry Elder, Western Yarrow, Letterman Needlegrass and Mountain Brome. Average annual precipitation is thirty-four inches.

The elevation of the Alpine is 10,800+ feet above sea level. Predominate plants of the Alpine Region are Cushion Eriogonum, Gordon Ivesia, Scribner Wheat grass and Redberry Elder. Average annual precipitation is forty inches.

Vegetation Type Units

The three major climate zones in Utah may be divided further into vegetation types. These vegetation types were mapped and described by A. W. Kuchler (1964), Potential Natural Vegetation of the Conterminous United States. A map of the vegetation units which comprises the three climatic zones is presented in Figure 2. Also included (Table 1) is a description of each vegetation units, its physiognomy, dominant vegetation and other descriptive components.



1	Douglas fir forest (Pseudotsuga)	7	Juniper-pinyon forest (Juniperus-Pinus)	13	Desert: vegetation largely absent
2	Western spruce-fir forest (Picea-Abies)	8	Mountain mahogany-oak scrub (Cercocarpus-Quercus)	14	Tule marshes (Scirpus-Typha)
3	Pine-Douglas fir forest (Pinus-Pseudotsuga)	9	Great Basin sagebrush (Artemisia)	15	Wheatgrass-bluegrass (Agropyron-Poa)
4	Arizona pine forest (Pinus)	10	Blackbrush (Coleogyne)	16	Alpine meadows and barren (Agrostis, Carex, Festuca, Poa)
5	Spruce-fir-Douglas fir forest (Picea-Abies-Pseudotsuga)	11	Saltbrush-greasewood (Atriplex-Sarcobatus)	17	Sagebrush steppe (Artemisia-Agropyron)
6	Southwestern spruce-fir forest (Picea-Abies)	12	Creosote bush (Larrea)	18	Galleta-three awn shrubsteppe (Hilaria-Aristida)

Figure 2. Vegetation units of Utah (Kuchler, 1964)

1. DOUGLAS FIR FOREST *(PSEUDOTSUGA)*

Physiognomy:	Medium dense forest of medium tall needleleaf evergreen trees
Dominants:	Douglas fir *(Pseudotsuga menziesii)*
Other Components:	*Abies concolor, Larix occidentalis, Physocarpus malvaceus, Picea pungens, P. glauca* (northern part), *Pinus contorta, P. ponderosa* (lower elevations), *Populus tremuloides*
Occurrence:	Northern Rocky Mountains and Washington

2. WESTERN SPRUCE-FIR FOREST *(PICEA-ABIES)*

Physiognomy:	Dense to open forests of low to medium tall needleleaf evergreen trees; open forests with a synusia of shrubs and herbaceous plants
Dominants:	Subalpine fir *(Abies lasiocarpa)* Engelmann spruce *(Picea engelmannii)*
Other Components:	*Arctostaphylos uva ursi, Arnica cordifolia, Calamagrostis canadensis, Cares* spp., *Larix lyallii, Menziesia ferruginea, Pinus albicaulis* (northern part), *P. contorta, Populus tremuloides, Pseudotsuga menziesii* (lower elevations), *Shepherdia canadensis, Symphoricarpos albus, Tsuga mertensiana* (western part), *Vaccinium* spp., *Xerophyllum tenax*
Occurrence:	High altitudes of northern Rocky Mountains and Washington

3. PINE-DOUGLAS FIR FOREST *(PINUS-PSEUDOTSUGA)*

Physiognomy:	Open to dense forests of tall needleleaf evergreen trees, often with much undergrowth
Dominants:	Ponderosa pine *(Pinus ponderosa)* Douglas fir *(Pseudotsuga menziessii)*
Other Components:	*Acer glabrum, Alnus tenuifolia, Blepharoneuron tricholepis, Ceanothus fendleri, Chamaebatiaria millefolium, Festuca arizonica, Holodiscus dumosus, Jamesia americana, Juniperus communis* var. *montana, Picea pungens, Pinus flexilis, Prunus emarginata, Ribes* spp., *Salix* spp.
Occurrence:	Southern Rocky Mountains

4. ARIZONA PINE FOREST *(PINUS)*

Physiognomy:	Open to dense forest of needleleaf evergreen trees, medium tall or tall, frequently with a herbaceous ground cover.
Dominants:	Ponderosa pine *(Pinus ponderosa)*
Other Components:	*Aristida* spp., *Blepharoneuron tricholepis, Ceanothus fendleri, Festuca arizonica, Holodiscus dumosus, Muhlenbergia montana, Physocarpus monogynus, Pinus cembroides* (southern part), *P. flexilis* (upper elevations), *P. leiophylla* var. *chiuahuana* (southern part), *Poa fendleriana, Pseudotsuga menziesii* (upper elevations), *Quercus gambelii, Stipa* spp.
Occurrence:	Arizona

Table 1. Utah vegetation types

5. SPRUCE-FIR-DOUGLAS FIR FOREST *(PICEA-ABIES-PSEUDOTSUGA)*

Physiognomy:	Open to dense forest of low to medium tall needleleaf evergreen trees with an admixture of broadleaf deciduous low trees and shrubs
Dominants:	White fir *(Abies concolor)* Blue spruce *(Picea pungens)* Douglas fir *(Pseudotsuga menziesii)*
Other Components:	*Acer glabrum, Amelanchier alnifolia, Chamaebatiaria millefolium, Pachystima myrsinites, Physocarpus malvacea, Populus tremuloides, Prunus virginiana, Sambucus glauca, Symphoricarpos vaccinoides*
Occurrence:	Southern Utah, northern Arizona

6. SOUTHWESTERN SPRUCE-FIR FOREST *(PICEA-ABIES)*

Physiognomy:	Dense to open stands of low to medium tall needleleaf evergreen trees
Dominants:	Corkbark fir *(Abies lasiocarpa* var. *arizonica)* Engelmann spruce *(Picea engelmannii)*
Other Components:	*Abies lasiocarpa, Acer glabrum, Juniperus communis, Pachystima myrsinites, Pinus aristata, P. flexilis, Populus tremuloides, Ribes* spp., *Salix bebbiana, Sambucus racemosa, Symphoricarpos vaccinoides*
Occurrence:	Southern Rocky Mountains and Arizona

7. JUNIPER-PINYON WOODLAND *(JUNIPERUS-PINUS)*

Physiognomy:	Open groves of needleleaf evergreen low trees with varying admixtures of shrubs and herbaceous plants
Dominants:	Oneseed juniper *(Juniperus monosperma)* Utah juniper *(Juniperus osteosperma)* Pinyon pine *(Pinus edulis)* (more in eastern part) Oneleaf pine *(Pinus monophylla)* (more in western part)
Other Components:	*Agropyron smithii, Artemisia tridentata* (not in southern part), *Bouteloua curtipendula, B. gracilis, Ceanothus* spp., *Cercocarpus* spp., *Chrysothamnus* spp., *Cowania mexicana, Fallugia paradoxa, Juniperus deppeana* (southern part). *J. occidentalis, Oryzopsis hymenoides, Purshia tridentata, Quercus emoryi, Q. gambelii, Q. grisea, Q. undulata, Sporobolus cryptandrus*
Occurrence:	California to Colorado; southward to Arizona and New Mexico

Table 1. Continued

8. MOUNTAIN MAHOGANY-OAK SCRUB *(CERCOCARPUS-QUERCUS)*

Physiognomy:	Dense to open vegetation of deciduous or semideciduous shrubs
Dominants:	Mountain mahogany *(Cercocarpus ledifolius)* Gambel oak *(Quercus gambelii)*
Other Components:	*Acer grandidentatum, Amelanchier utahensis, Arctostaphylos* spp., *Ceanothus velutinus, Cowania mexicana, Fallugia paradoxa, Pachystima myrsinites, Physocarpus malvaceus, Purshia tridentata, Quercus havardii, Q. turbinella, Q. undulata, Rhus trilobata, Symphoricarpos* spp.
Occurrence:	Utah, Colorado

9. GREAT BASIN SAGEBRUSH *(ARTEMISIA)*

Physiognomy:	Fairly dense to open vegetation of low to medium tall shrubs
Dominants:	Big sagebrush *(Artemisia tridentata)*
Other Components:	*Agropyron smithii* (northern part), *Artemisia nova, atriplex confertifolia,* and species of *Astragalus, Chrysothamnus, Coleogyne* (southern part), *Ephedra, Eriogonum, Lupinus, Phacelia, Tetradynia*
Occurrence:	Great Basin, eastward to Colorado, southward to Arizona and New Mexico

10. BLACKBRUSH *(COLEOGYNE)*

Physiognomy:	Dense to open stands of broadleaf evergreen shrubs, frequently with an open understory of grass
Dominants:	Blackbrush *(Coleogyne ramosissima)*
Other Components:	*Artemisia tridentata, Ephedra* spp., *Gutierrezia sarothrae, Haplopappus linearifolius, Hilaria jamesii*
Occurrence:	Southern Utah, northern Arizona

11. SALTBUSH-GREASEWOOD *(ATRIPLEX-SARCOBATUS)*

Physiognomy:	Open stands of low shrubs and dwarf shrubs
Dominants:	Shadscale *(Atriplex confertifolia)* Greasewood *(Sarcobatus vermiculatus)*
Other Components:	*Allenrolfea occidentalis, Artemisia spinescens, Atriplex* spp., *Distichlis spicatum, Eurotia lanata, Grayia spinosa, Kochia americana, Lycium cooperi, Menodora spinescens* (western part), *Suaeda torreyana*
Occurrence:	Great Basin and eastward to Wyoming, southward to New Mexico

Table 1. Continued

12. CREOSOTE BUSH *(LARREA)*

Physiognomy:	Open stands of low to medium tall shrubs and dwarf shrubs
Dominants:	Creosote bush *(Larrea divaricata)*
Other Components:	*Baccharis sergiloides, Encelia farinosa, Franseria dumosa, Lycium andersonii, Sphaeralcea ambigua*
Occurrence:	Southeastern California, southern Nevada, northwestern Arizona

13. DESERT

Vegetation largely absent

14. TULE MARSHES *(SCIRPUS-TYPHA)*

Physiognomy:	Tall graminoid vegetation
Dominants:	Common tule *(Scirpus acutus)* California bulrush *(Scirpus californicus)* Olney bulrush *(Scirpus olneyi)* Tule *(Scirpus validus)* Cattail *(Typha domingensis)* Soft flag *(Typha latifolia)*
Other Components:	*Carex senta, C. obnupta, Heleocharis palustris, Typha angustifolia*
Occurrence:	Widespread. Greatest extent in the Central Valley of California; elsewhere, especially along shallow lake shores as along the northeastern banks of Great Salt Lake.

15. WHEATGRASS-BLUEGRASS *(AGROPYRON-POA)*

Physiognomy:	Dense, low to medium tall grassland
Dominants:	Bluebunch wheatgrass *(Agropyron spicatum)* Idaho fescue *(Festuca idahoensis)* Sandberg bluegrass *(Poa secunda)*
Other Components:	*Achillea millefolium* var. *lanulosa, Astragalus* spp., *Chrysothamnus nauseosus, Draba verna, Festuca pacifica, Lithophragma bulbifera, Lupinus sericeus, Plantago purshii, Stellaria nitens*
Occurrence:	Washington, Oregon, northwestern Idaho

Table 1. Continued

16. ALPINE MEADOWS AND BARREN *(AGROSTIS, CAREX, FESTUCA, POA)*

Physiognomy:	Usually short grasses and sedges, dense to very open with extensive barren areas; many forbs
Dominants:	Bentgrass *(Agrostis* spp.*)* Sedges *(Carex* spp.*)* Hairgrass *(Deschampsia caespitosa)* Fescue *(Festuca viridula)* Woodrush *(Luzula spicata)* Mountain timothy *(Phleum alpinum)* Bluegrass *(Poa* spp.*)* Spike trisetum *(Trisetum spicatum)*
Other Components:	*Achillea* spp., *Antennaria* spp., *Aquilegia* spp., *Arenaria* spp., *Castilleja* spp., *Draba* spp., *Erigeron compositus,* lichen spp., *Oxyria digyna Pentstemon fruticosus, Phacelia* spp., *Phlox caespitosa, Polemonium* spp., *polygonum* spp., *Potentilla diversifolia, Potentilla* spp., *Salix nivalis, Salix* spp., *Saxifraga* spp., *Selaginella* spp., *Sibbaldia procumbens, Sieversia turbinata, Solidago* spp.
Occurrence:	Rocky Mountains, Cascade Range, Sierra Nevada

17. SAGEBRUSH STEPPE *(ARTEMISIA-AGROPYRON)*

Physiognomy:	Dense to open grassland with dense to open shrub synusia
Dominants:	Bluebunch wheatgrass *(Agropyron spicatum)* Big sagebrush *(Artemisia tridentata)*
Other Components:	*Artemisia arbuscula* (western part), *A. nova* (eastern part), *Balsamorrhiza sagittata, Festuca idahoensis, Lithospermum ruderale, Lupinus sericeus, Oryzopsis hymenoides, Phlox* spp., *Poa nevadensis, P. secunda, Purshia tridentata, Sitanion* spp.
Occurrence:	Pacific Northwest and eastward to Rocky Mountains

18 GALLETA-THREE AWN SHRUBSTEPPE *(HILARIA-ARISTIDA)*

Physiognomy:	Open grassland with low shrubs
Dominants:	Three awn *(Aristida longiseta)* Sandsage *(Artemisia filifolia)* Mormon tea *(Ephedra viridis)* Galleta *(Hilaria jamesii)*
Other Components:	*Aster cichoriaceus, Berberis fremontii, Bouteloua gracilis, Chrysopsis villosa, Chrysothamnus nauseosus, C. viscidiflorus, Ephedra torreyana, Euploca convolvulacea, Franseria acanthicarpa, Helianthus anomalus, Mentzelia pumila, Muhlenbergia pungens, Munroa squarrosa, Oenothera albicaulis, Oryzopsis hymenoides, Poliomintha incana, Quercus undulata, Sphaeralcea grossulariaefolia, Sporobolus cryptandrus, Stephanomeria pauciflora*
Occurrence:	Southeastern Utah

Table 1. Continued

Climate and Microclimate

Introduction

The three climate zones of Utah are characterized by climate variations which influence the distribution of native plants throughout the state. Hunt stated that,

> Plant distribution, the subject of plant geography, is controlled partly by climate and partly by geology. The local variations in climate include both those of the macroclimate and microclimate; the four principal factors affecting plant growth are light, temperature, precipitation, and wind. (Hunt, 1967, p. 187)

To chose proper native plants for a particular site, the regional climate of the area and the microclimate of the site must be known. Important factors of climate are light and radiation, temperature, precipitation and wind. These climatic factors may be altered due to the physical character of a particular site. The resulting condition is microclimate. Lynch, in his book, Site Planning describes a microclimate as a "local modification of the general climate that is imposed by the special shape of a small area: its topography, cover, ground surface and man-made forms." (Lynch, 1973, p. 65)

Microclimate is important for plant survival. Bannister pointed out that,

> Plants exist in a physical environment near the surface of the ground; their roots penetrate a little distance into the earth's crust and their shoots a little way into the atmosphere, but on a global scale they can be considered as only superficial. However, within this narrow layer, the interaction between plant and environment is complex: the physical environment determines the plants which grow, whilst the plants influence the physical environment.

> Surfaces have special properties with the result that the immediate environment of either bare or vegetated surfaces is markedly different from the gross environment that surrounds them. (Bannister, 1976, p. 9)

The remainder of this section discusses the factors which influence climate and microclimate.

Climate

The factors which makeup climate are radiation, temperature, precipitation and wind. Each of these factors are discussed in relation to plant response to the factor.

Radiation. Plants basically respond to radiation through the process of photosynthesis, photoperiodism, radiation absorption and radiation reflection. The sun is the source of radiant energy.

> This energy, radiating as waves, includes those wave lengths of the visible spectrum that we term "light" and those that lie just beyond the visible spectrum called "heat" if slightly longer, or "ultraviolet light" if shorter. The amount of insolation reaching the earth is always reduced because of absorption by the atmosphere (6-8 percent), and as much as 40 percent may be reflected by clouds. The remainder reaching soil or water on the earth may be further varied by such factors as distance from the sun at different seasons, duration of radiation, and the angle of the rays with the earth's surface. (Oosting, 1950, p. 116).

Temperature. Temperature is a critical factor in determining plant selection. Every plant species has a temperature range which it can tolerate.

> . . . Temperature influences such plant activities as transpiration, respiration, germination, growth, and reproduction. Temperature extremes are important, but their duration and the length of the growing season, or frost-free period are also significant. (Wilson, Loomis and Steeves, 1971, p. 370)

For successful use as a landscape species a plant should be able to survive the lowest temperature on record for any given site. This temperature may not occur during the growing season but when a plant is in a dormant state, thus the plant may escape freezing damage unless it occurs in the spring. High temperatures are as critical to a plant as are low temperatures. The maximum temperature which plants can withstand are 130 to 140 degrees fahrenheit. Oosting discussed how temperature range effect plant growth processes:

> The effective temperature range, however, is usually between 70° and 100° F. With increase in temperature the rate increases steadily to the optimum and then drops abruptly to the maximum, which is not much in excess of the optimum. The rate of respiration also increases with temperature until at high temperatures the process becomes destructive of life. (Oosting, 1950, p. 128)

"High temperatures increase the rate of evaporation from the soil, but more importantly, they increase the rate of transpiration." (Wilson, Loomis and Steeves, 1971, p. 371). Grivith (1976, p. 108) defined evaporation as "the loss of water from either soil or water as it changes from a liquid to a vapor in the air." Transpiration is the loss of water from the leaves and stems of the plant. About 90 percent of the water a plant takes in is lost to transpiration.

Precipitation. Precipitation is one of the most critical factors in determining whether a plant will survive at a given site. The influence of annual precipitation may be modified by its seasonal distribution.

> The seasonal distribution of rainfall may be more important than the total amount . . . spring and early summer rains are generally preferable to those of fall and winter. If precipitation is concentrated in the

> winter, perhaps as snow, so that a deep layer of subsoil is soaked, forests may exist in regions of relatively low total rainfall. Summer rainfall under the same conditions favors shallow-rooted plants like the grasses. (Wilson, Loomis, and Steeves, 1975, p. 371)

The moisture needs of different species also vary, thus plants with high water needs will deplete the water from the soil around them faster than plants with lower moisture needs. According to Plummer, (n.d., p. 22) to succeed in establishing shrubs and forbs by direct seeding in Utah, annual rainfall must be more than nine inches.

Figure 3 shows the effective precipitation required for the vegetation types of the desert, grassland and forest areas.

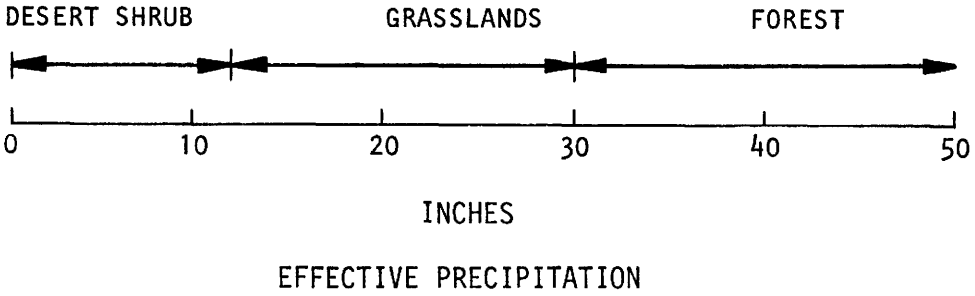


Figure 3. Precipitation chart for vegetation type

Depending on topography and orientation of the slope in relation to the wind during a rain storm, the amount of rain and its effect can vary from one location to another. Slopes that face the prevailing wind may be more saturated than those slopes facing the opposite direction. Other factors which determine soil moisture content include soil texture, angle of the slope and surface conditions. These factors

influence runoff and soil percolation during heavy rains. Evaporation is also affected by the slope and exposure of a site (Harris, 1971, p. 21).

Wind. The definition of wind is air which moves from a region of high pressure to one of low pressure. Wind affects the distribution and shape of plants. Hunt stated:

> . . . The absence of trees at some exposed situations is due to wind, partly because of physical damage to anything standing upright, partly because of excessive transpiration, and partly because of the decrease in soil temperature due to the removal of the protective cover of snow. (Hunt, 1967, p. 188)

Microclimate

Typically, microclimate is defined as the climate in a small space. Gates, in referring to the importance of microclimate stated that "The climate surrounding an organism is the climate which is really significant for the comfort, behavior and viability of the organism." (Gates, 1973, p. 32)

As a highway transverses any section of land, it will be located within a climatic zone which has general radiation, temperature, precipitation, and wind characteristics. These climatic factors are modified on a smaller scale by elevation, exposure, and vegetative cover. According to Gieger (1965, p. 2)

> All the meteorological elements are subject to vertical changes because of the nearness of the ground; and in a similar way they also vary horizontally within short distances. These variations are brought about by changes in the nature and the moisture of the soil, even by minute differences in surface slopes, and by the

> type and height of vegetation growing on it. All these climates found within a small space are grouped together under the general description of microclimate, and are thus contrasted with the macroclimate . . .

The following will briefly discuss the factors that influence microclimate.

Elevation. There is a direct correlation between elevation and temperature. The higher the elevation, the longer and colder the winter. According to Hopkin's Bioclimatic law, a climb of 1,000 feet is roughly equal to a trip of 600 miles northward. Average temperature is decreased approximately 3°F for every 1,000 feet in altitude. This change in temperature and elevation is one way of classifying the distribution of vegetation. A particular species, such as spruce, will grow at a high elevation in the southern part of the state, but that same species will be found at lower elevations in the northern portion of the state.

Exposure. Exposure is a factor which significantly influences temperature. The regional temperature is not necessarily the same as the temperature at a given site. Thus, exposure is an important factor of determining microclimate. Geiger stated, "Slope climate or exposure climate is determined, in the first place, by the different amounts of direct solar radiation and heat received by an inclined surface as compared with a horizontal surface." (Geiger, 1965, p. 49)

The greatest microclimatic difference exists between the north and south facing slopes. South facing slopes receive more radiant heat because of the direct angle of incidence of the sun's rays, than

do the north facing slopes. According to Oosting (1950, p. 124),

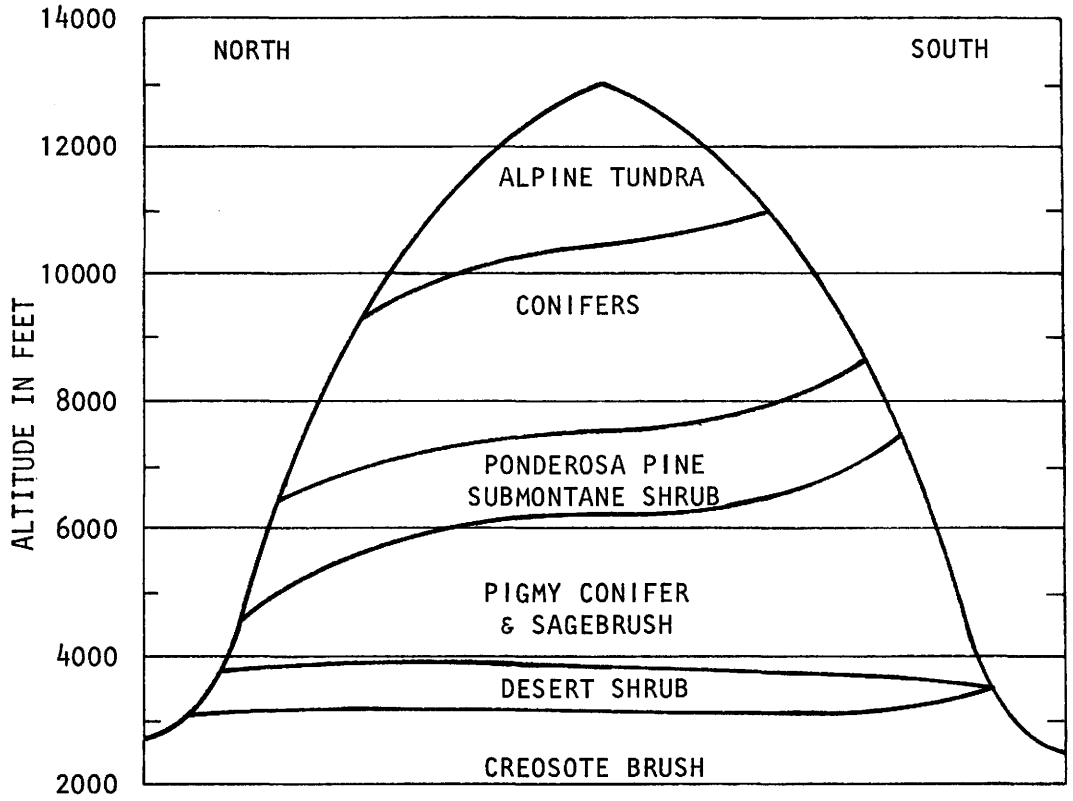
> Thus the same temperature conditions found on a tableland may occur at a higher altitude on a near-by south-facing slope and at a lower altitude on a north slope. The distribution of vegetation being correlated with temperature and the consequent moisture differences, a particular community will be found above its ordinary altitudinal range on south slopes and below it on north slopes, and the extent of this irregularity in zonation is affected both by the angle of the slope and its exposure.

(Figure 4) Thus, the microclimate can range from a warm and dry condition on a south-facing slope to a cooler and more humid condition on a north-facing slope. These factors help to determine which plants will successfully survive in these different areas.

Evapotranspiration of moisture from soil and plant materials is higher on south facing slopes. Snow pack on south and southwest facing slopes melts and evaporates quickly, which results in lower soil moisture for the site. Typically, these conditions result in a grass or shrub vegetation type.

In contrast, north facing slopes are characterized by deep, moist soils and tree covered slopes. The snow pack on slopes facing north and northeast will persist, resulting in a high moisture content of the soil and cool conditions. This, in part, accounts for the forested areas of these sites.

Climatic effects of plants. Plant materials also alter climatic conditions, therefore, they are a factor in creating microclimates. An area with little or no vegetation will have a high temperature near the soil, but as vegetation cover increases in height and density, radiant energy is absorbed by the canopy. This results in a lower



A generalized profile of altitudinal zones of vegetation in the mountains of Utah, which illustrates the effects of northern and southern exposures (Oosting, 1950, p. 107)

Figure 4. Microclimatic orientation

temperature at the base of the plants. Dense vegetation will also reduce air movements to convection and diffusion which creates a calm at ground level. This calm climate near the ground is important because it influences both temperature and humidity and creates a favorable environment. Within growing vegetation relative humidity is much higher than above the plants. Near saturation conditions may exist in some cases.

Soil

For the plant community, soil can be as important as precipitation and temperature. In some cases, soil is even the limiting factor of plant growth. Important factors that affect the distribution, growth and survival of a plant are the soil's texture and structure, fertility, water content, temperature, organic matter, mineral composition and degree of acidity.

Soil texture, the size of soil particles, and soil structure, the shape of particles which determine how they fit together, may vary within a short distance. Soil texture and structure influence soil moisture and aeration and thus affect plant growth. For example, sandy soils dry more rapidly than clay soils. Clay soils are more difficult to penetrate, but have more mineral nutrients than soils that are quartz sand. Drainage is rapid in coarse texture soils, but in clays, movement of water is slow because pores are small and may be blocked.

Soil water is one of the most important factors which affect plant growth. Soil water can be classified into four categories: gravitational water, capillary water, hygroscopic water and water vapor. The availability of soil water to plants is the most important aspect of soil water. Oosting stated,

> Gravitational water is readily available to plants only when present in a saturated soil, a condition that rarely continues long enough to be of importance. Normally, then, readily available water is that capillary water in the range between field capacity and the permanent wilting percentage. (Oosting, 1950, p. 171)

The temperature of the soil is a factor in plant growth. Temperature affects absorption of water and mineral nutrients. At low

temperatures the rate of absorption is lower and bacteria are more inactive than under warmer soil conditions.

The organic content of soil is comprised of dead organic matter and the organisms which live in or on the soil. Both the vegetative cover and the organic litter at the surface affect the soil temperature, the moisture content in the soil, chemistry and compactness. Organic matter in the soil modifies soil structure and provides certain plant nutrients.

Conditions Peculiar to Highways

It must be remembered that highways are artificial man-made environments which transverse through a variety of different plant communities and topography. Prior to construction of a highway, a plant community existed to protect the soil with various kinds of vegetation. "This protective cover is destroyed by all construction activities in which large acreage of soil and underlying geologic material are stripped of all living plants and organic matter and made bare and barren." (Environmental Protection Agency, 1975, p. 31)

Highways do not have naturally formed soil profiles or normal precipitation, drainage or temperature. Highway construction sties which are to be revegetated may have extremely compacted subsoil, due to heavy earth-moving machinery and equipment. These sites are

> . . . often left exposed on steep and smooth cut slopes that resist wetting, or as raw fill slopes that slake and flow during the rains. This unprotected earth surface becomes a source of dust and sediment; it is also a more critical environment for reestablishing protective vegetation. (E.P.A., 1975, p. 31)

Plant roots may have difficulty penetrating these compacted soils, which can result in a limited moisture supply for the plant.

Highway cuts and fills often create a variety of microclimates along the site. The E.P.A. manual stated that,

> Plants growing on steep road cuts, even in humid regions, are living in an ecological minidesert; whereas plants on fills in actual desert areas may have adequate soil water because of the effect of the waterproof road surface acting as a miniwatershed. Plants growing in some ditches and in seepage areas are, in fact, in a marsh environment. (E.P.A., 1975, p. 33)

The soils that are used for highway fills are often brought in from other sites and may not match the existing soils. Consequently, a plant that may grow naturally on land next to the highway may not survive on the man-made environment. Additional environmental problems may be created by heat that is radiated from the surface of the highway. This heat can be a determining factor of the survivability of vegetation located along these highways. Other problems which may be encountered are excessive salts which are used for highway deicing and vehicle exhaust which causes carbon monoxide burn on plants.

The preceding information has been given to help to determine the survivability of plant materials for highway landscaping. A highway system whether it is an interstate or rural road will transverse a variety of different land uses such as urban, rural, farm and rangelands. Each one of these areas will be an added consideration in determining the type of plant materials that will be required for highway planting and revegetation.

Criteria Set by Highway Design Standards

AASHTO state in their publication A Guide for Highway Landscaping and Environmental Design that "the complete highway is one wherein the elements of design, construction and maintenance have been integrated to provide a highway facility that possesses the optimum of utility, safety, beauty and economy." (AASHTO, 1970, p. ii)

The following information will be a selective summary of standards set forty by AASHTO for landscaping of highways. It is felt that this should be done in order to show what specifications have been established. It will include information pertaining to erosion control, location and placement of plants and maintenance.

Seeding and planting should be included in the initial construction in order to ". . . protect against slope erosion and drainage clogging." (AASHTO, 1954, p. 50) They also stated that an appropriate means of erosion control for the earth surfaces along highway roadsides was a necessity and that "Specifications require the establishment of a vegetation cover or effective mulch on the newly graded area as the work progresses." (AASHTO, 1970, p. 17)

On the subject of plant placement, AASHTO advised that there was a need to achieve a "natural" appearance for the region by using additional shrub and tree plantings for certain areas. This material should be set back from the traveled way and located so as not to impair sight distances. Plant material "should be of types native to the area and located in natural groups . . ." (AASHTO, 1973, p. 404) It was also felt that "Along rural highways, natural regeneration should be encouraged." (AASHTO, 1970, p. 34) AASHTO also stated that

shrubs and trees should be used to screen undesirable views such as junk yards, railroads, or industrial areas.

For vehicular safety, trees which will have a four-inch diameter trunk or larger at maturity should not be placed closer than thirty feet from the traveled way. Where guardrail or barrier curbs are used, plantings must be set back six feet from the roadway.

According to AASHTO, maintenance is an important factor in landscaping. They advised that "maintenance is a factor in determining the most effective and economical design for roadside grading, drainage, erosion control, and planting appropriate to the local soil, climatic and other conditions." (AASHTO, 1970, p. 34)

Because of the length of highways, achieving adequate maintenance is often a problem. Therefore, the planting design and selection of plants should result in a low maintenance requirement. "Areas of mowing may be reduced by appropriate plantings . . . Do not use materials that require special care to prevent or control insects or diseases. Avoid plants that are weak, brittle, or easily broken by wind or snow load." (AASHTO, 1970, pp. 34, 36)

Summary

Design authorities (Crow, 1960; Tunnard and Pushkarev, 1963; and Brewster, 1959) suggest that plant material used for highway planting should be native to the area and be allowed to perpetuate or establish themselves in native plant communities along the highways. It was felt that this type of planting achieves a natural appearance and reduces maintenance cost.

Through correspondence with the highway departments of Arizona, New Mexico, Wyoming and Idaho it was determined that native grasses and shrubs have been used for highway planting and revegetation. The use of natives prove beneficial in both dry land and irrigated plantings.

The important points within AASHTO standards are summarized as follows:

1. The complete highway is one in which design, construction and maintenance are integrated to possess the optimum of utility, safety, beauty and economy;

2. Seeding and planting should be included in the initial construction for protection against erosion;

3. Plant material should be native to the area and located in natural groups;

4. Natural regeneration should be encouraged in rural areas;

5. Planting design and selection of plants should result in a low maintenance scheme;

6. Plants that require special care and maintenance should be avoided.

All of these points suggest that native plant materials should have a high priority for use in highway plantings.

CHAPTER III

RESULTS OF THE STUDY

Introduction

To better understand the present landscaping practices of UDOT, a case study was carried out on a predetermined section of Interstate Fifteen and Interstate Eight-North in the north-central portion of the State of Utah. (Figure 5) The specific aims of the study were to determine the present condition of the plant materials used by UDOT for highway planting on the project, and to determine how successful these plants were adapting to the highway environment. An additional aim was to determine what native plant materials were existing on the sites and to determine how well they were adapting to the environmental changes created by the construction of the highways. To complete the case study the following steps were undertaken.

1. The case study site was chosen using the following criteria:

A. The study area had to be an older section of highway so that the plant materials planted by UDOT would have a sufficient period of time to become established;

B. The study area had to have a contrast between the plant materials used by UDOT and the existing natural landscape;

C. The study area had to be of an adequate length to assure that environmental variations, created by highway alignment, cuts and fills, would be existing in the study area. This would provide a diversity of environments for plants to adapt to.

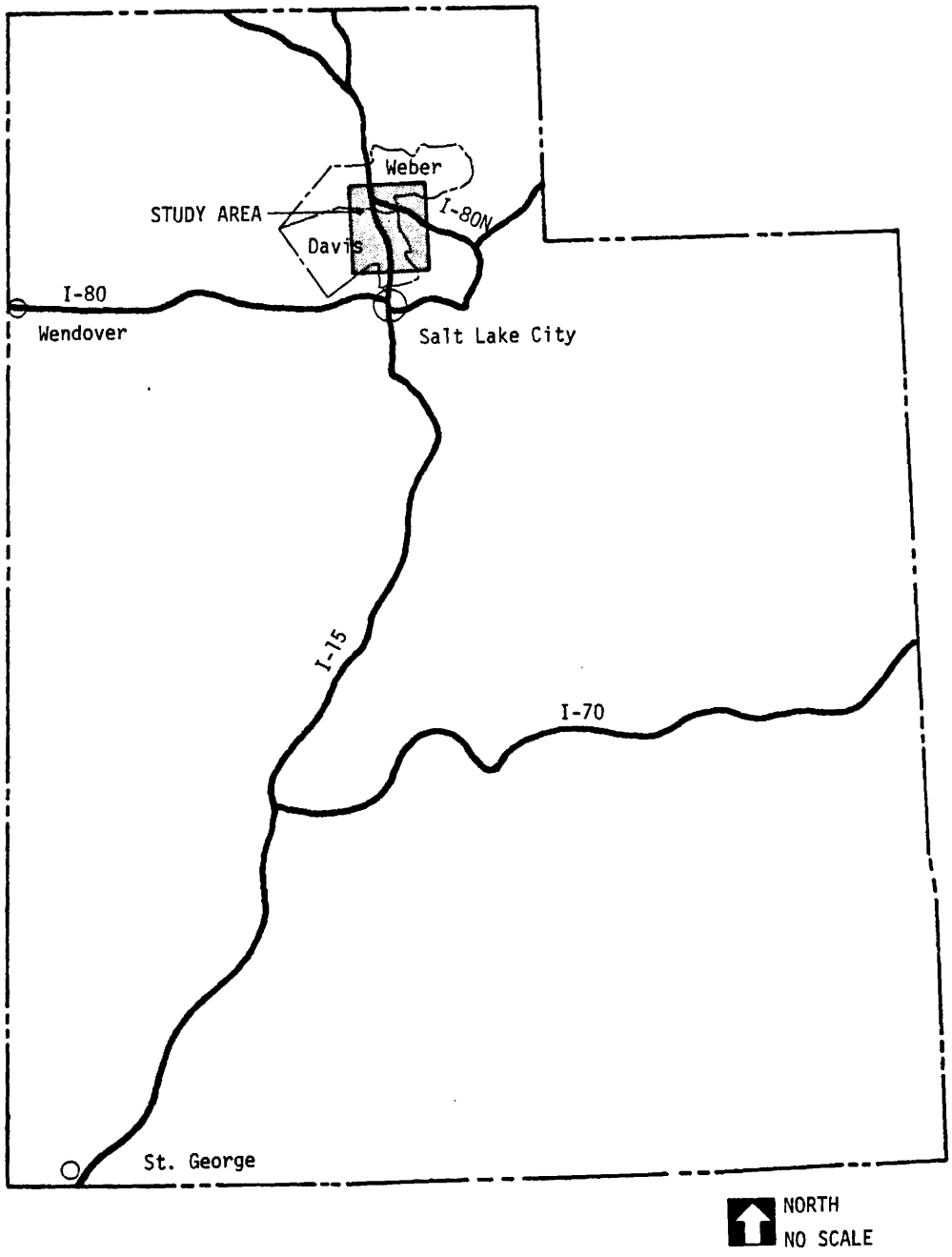


Figure 5. Location Map of Study Area in Utah

D. The project plans for the study had to be available to determine location and type of plant material used by UDOT;

E. The cost estimate invoice for the project had to be available to determine UDOT's cost loss for plant material used on the site.

A section of Interstate Fifteen and a section of Interstate Eighty-North were chosen because together the two projects fulfilled the criteria.

2. Planting plans for the sites were obtained;

3. An estimate invoice (cost list) was obtained which determined the cost of the plant material used for the project;

4. Photographs of the site were taken together with field studies to determine the existing condition of the plant material;

5. Environmental factors, such as soil conditions, annual precipitation, frost free days and elevations were studied to determine which native species could grow on the study site;

6. Information pertaining to the maintenance carried out in the study area was obtained.

Delineation of the Case Study Area

The study area is comprised of two sites located on the Utah interstate highway system, in Davis County and Weber County. (Figure 6) Site I is a section of Interstate Fifteen which is located between South Layton and 31st Street in Ogden. This site is comprised of two separate projects. The first project is between South Layton and the Davis-Weber County line. It is located in Davis County and has a length of 8.437 miles. (I-15-7(69)326 2nd Contract). The second

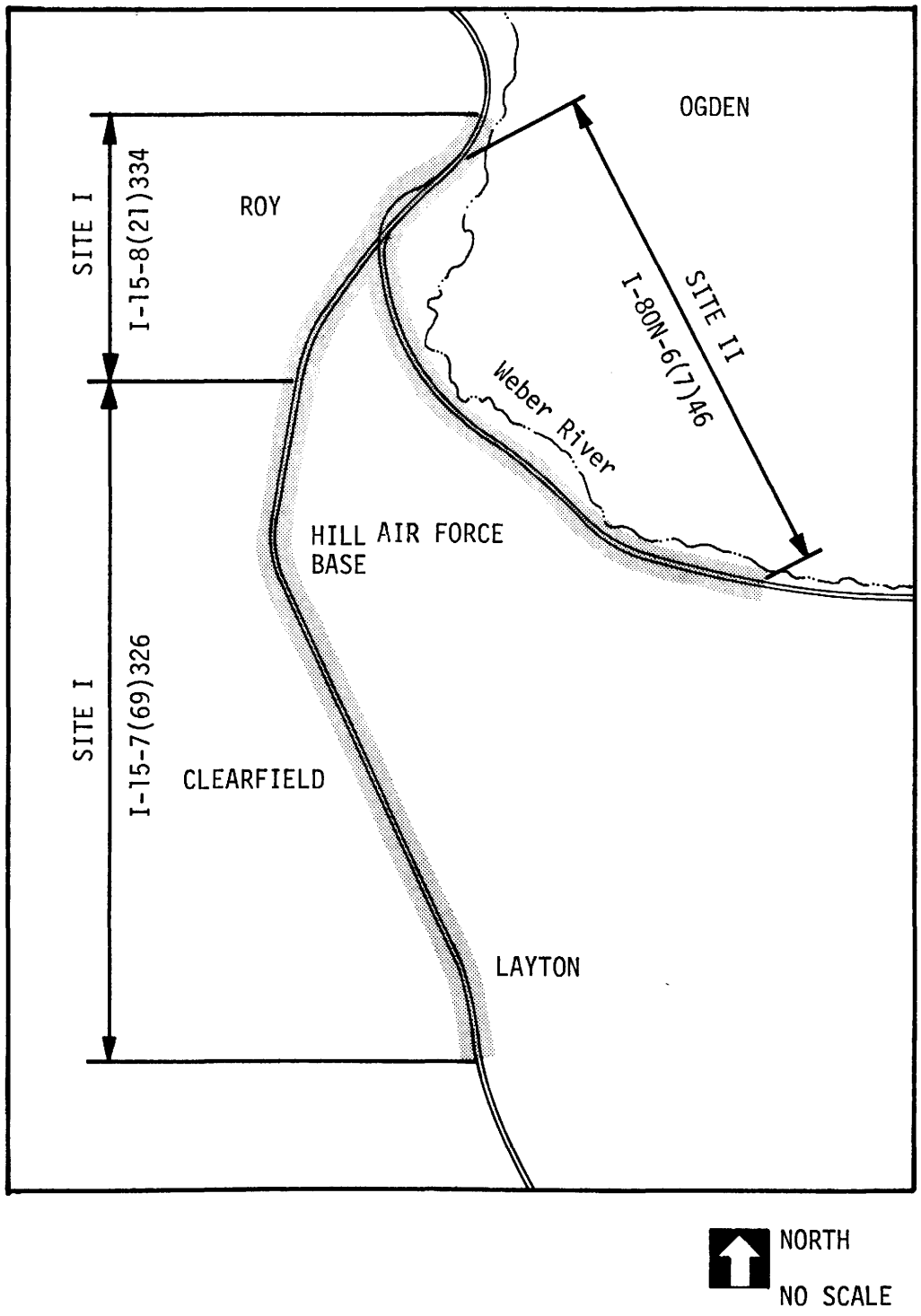


Figure 6. Map of study area

project starts at the Davis-Weber County line and continues to 31st Street in Ogden. It is located in Weber County and has a length of 3.867 miles, (I-15-8(21)334 2nd Contract). This section of Interstate Fifteen was chosen because it was planted in 1966 and thus has had eleven years to become established. The site is laid out in a north-south direction and has east and west exposures created by the cuts and fills required for the highway alignment. The highway transverses both the urban and rural areas of Davis County and Weber County.

Site II is a section of Interstate Eighty-North which is located between Riverdale and Uintah Junction in Weber County. It has a length of 6.777 miles (I-80N-6(7)46). Interstate Eighty-North is oriented in an east west direction and is constructed on relatively level topography with few cuts and fills to create slope exposures. The highway alignment follows the course of the Weber River which runs through a variety of native plant communities.

Site Characteristics

Introduction

During the summer and autumn months of 1976, numerous trips were made to the sites for the purpose of inspecting and identifying the existing plant materials. Copies of the project plans were obtained to help gather information pertinent to the study. These were used to determine what plant materials were originally planted, their number and location. At this time, the natural flora of the sites were also observed.

Further information pertaining to the sites was also compiled from written literature and personal interviews.

Geographic location

Geographically, the Davis-Weber County area is located west of and adjacent to the Wasatch Mountain Range which runs north and south through the state. The Great Salt Lake is to the west. Because of the high content of salt, the lake never freezes during the winter. This causes a modifying effect on the measured precipitation and temperature of the area, which is characterized by warm dry summers and cold but not severe winters. Due to the topographic conditions, the growing season or frost free period of the region ranges from 150 to 175 days making it suitable for farming.

Adjacent land use

Farming is one of the important features of the area, although, in recent years it has been reduced by residential and industrial development. Still, farming is fairly well diversified throughout most of the two counties. The principal crops are orchard fruits, grain and truck crops, sugarbeets and pasture and hay crops. Most of these areas require some type of irrigation throughout the growing season. Water for irrigation purposes comes from the Weber and Ogden Rivers which run through the area. Some early spring irrigation comes from small streams that flow out of the Wasatch Mountains.

Precipitation

Precipitation for the area is generally moderate during summer and early fall. The periods of greatest precipitation come in the spring when storms from the Pacific Northwest are more intense. April is generally the wettest month averaging more than 2-1/4 inches of rain. From December to March, the area receives about one-third of its annual moisture in the form of snow. The average annual precipitation for the area ranges from 15 to 20 inches. (Figure 7).

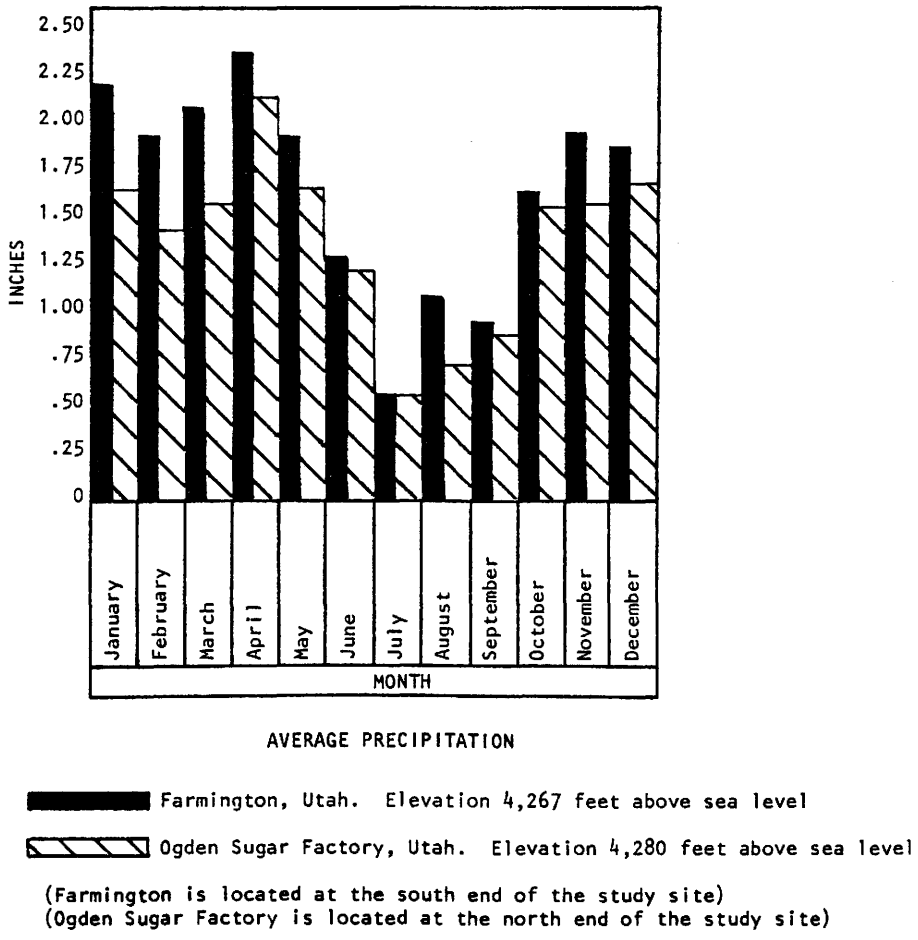


Figure 7. Precipitation Chart for Study Area

Winds

Winds in the area are generally light to moderate, less than 20 miles per hour. Occasionally, strong easterly winds from the canyons will cause damage in the area, but these strong winds do not blow more than five miles distance from the mouth of the canyons.

Elevations

From a base elevation of 4377.64 feet above sea level at Riverdale, Interstate Eighty-North rises gradually to an elevation of 4526.04 feet above sea level at Uintah Junction. The change in elevation is not detected due to the constant slope of the land. Elevations in the area of Interstate Fifteen range from 4424.75 feet above sea level at Layton down to 4331.88 feet above sea level at Ogden. As with Interstate Eighty-North there is little noticeable change in elevation due to the gradual grade change over the total length of the site.

Soils

The soils of the Davis-Weber areas are used mostly for dry farming, irrigated crops, pasture and rangeland. These soils are classified into ten associations. Soil association are useful in obtaining general information about the types of soils which occur in an area and what plants grow on it. The following five soil associations are found on the case study site (USDA, 1968, p. 6).

Parleys-Timpanogos-Kidman Association. Parleys-Timpanogos-Kidman Association soils are well drained and moderately well drained loams, fine sandy loams, and very fine sandy loams on terraces of

of medium heights; this association is located on the strongly sloping and steep terrace escarpments that face south. Parleys, Timpanogos and Kidman soils are the major soils of the association, all are deep and well drained or moderately well drained. Permeability is moderately rapid to moderately slow, available water capacity is high. Natural fertility is moderately high to high. Hillfield and Ackmen are minor soils of the association, these soils are deep and well drained. Hillfield soils are on steep terrace escarpments, Ackmen soils are on nearly level to moderately steep alluvial fans or along drainageways. Soils in this association are used for irrigated and nonirrigated crops, orchards and range and the native vegetation is mainly Gambel Oak, Sagebrush and bunch grasses. Elevations range from 4,350 to 5,100 feet above sea level.

Kidman-Layton Association. Kidman-Layton Association soils are well drained and moderately well drained fine sandy loams and loamy fine sands on terraces of medium height. Kidman and Layton are the major soils of the association, both are deep and well drained or moderately well drained. Permeability is rapid to moderately rapid, available water capacity is moderate to high. Natural fertility ranges from high to moderate. Preston, Francis and Timpanogos are the minor soils of the association. Soils are used chiefly for irrigated and nonirrigated crops, orchards, range land and some community developments. The native vegetation consists of Gambel Oak, Sagebrush, Rabbit Brush, Indian Rice grass, Cheatgrass, Brome and Sand Dropseed. Elevations range from 4,350 to 5,100 feet above sea level.

Sunset-Kirkham-Martini Association. Sunset-Kirkham-Martinia Association soils are somewhat poorly drained and moderately well drained, dark-colored, slightly saline-alkali loams, fine sandy loams, and silty clay loams on flood plains and in depressions on terraces. Sunset, Kirkham and Martini are the major soils of the association. All these soils formed in alluvium or old lake sediments and range from gravelly loamy sand to silty clay loam in texture. Permeability is moderate to moderately slow, available water capacity is high. Natural fertility is moderately high. Refuge, Steed and Wayment are the minor soils of the association. The high salt content of these minor soils limits plant growth. Some areas are used for irrigated crops, pasture and rangeland, other areas are wildlife inhabitated or barren. The native vegetation varies from Sagebrush, Greasewood, Poverty Wood, Cheatgrass, Brome, Peppergrass, Pickleweed and Saltgrass to Cottonwoods, Boxelder, Willows, Tules and Rushes. Elevations range from 4,220 to 4,600 feet above sea level.

Kilburn Association. Kilburn Association soils are well drained to somewhat excessively drained, gravelly and cobbly sandy loams of the alluvial fans, high terraces and old deltas. Kilburn is the major soil of the association, it is deep or moderately deep, gravelly, cobbly, or stony sandy loams that are well drained to somewhat excessively drained. Permeability is moderately to rapid, available water capacity is moderate. Natural fertility is moderate to moderately low. Sterling, Ridd, Francis and Pleasant View are the minor soils of the association. Soils are used chiefly for irrigated and non-irrigated crops, orchards, rangeland, water sheds and some

community development. The native vegetation consists of Gambel Oak, Sagebrush, Western Wheatgrass, bunch grass, Indian Rice Grass, Sand Dropseed and Lupine. Elevation ranges from 4,400 to 5,200 feet above sea level.

Preston-Francis Association. Preston-Francis Association soils are excessively drained fine sands and loamy fine sands of the high lake terraces. Preston and Francis are the major soils of the association. They are deep and have rapid permeability. These soils are droughty, have low available water capacity, and have low to moderate natural fertility. They are susceptible to severe soil blowing. Layton, Kidman and Kilburn are the minor soils of the association. Soils of this kind are used mainly for irrigated and nonirrigated crops orchards, rangelands, watersheds and some community development. The natural vegetation is mainly Gambel Oak, Sagebrush, Rabbit brush, Indian Rice Grass, Cheatgrass, Brome, Sand Dropseed and bunchgrass. Elevations range from 4,400 to 5,200 feet above sea level.

Highway soils. UDOT highways are designed to balance the amount of cut and fill materials as much as possible to reduce cost. Cut materials removed during the construction period are transported to the nearest location which requires fill material. Where it is not feasible to haul the material from one location on the site to another due to travel distance, fill material is obtained from the nearest available source. In general, the soils used for highway construction are the existing soils of the site or are soils from a nearby location.

Because these soils are disturbed and compacted, many of their original characteristics are altered.

Wildlife

The areas adjacent to Interstate Fifteen and Interstate Eighty-North have many natural habitats for attracting wildlife. These habitats are located mainly in large gullies, drainage ways, ditch-banks and hillsides, and are a source of food, cover, water and living space. Pheasants, morning doves, ducks, geese, mule deer, skunks, rabbits, muskrats and other small rodents inhabit these areas.

Interstate Fifteen has topography which is flat and open with some washes and gullies. The vegetation is primarily low growing shrubs and grasses which is favorable habitat for small mammals and birds.

The topography of Interstate Eighty-North, along the Weber River, affords a multitude of habitats for wildlife. Dense areas of trees, shrubs and grasses grow abundantly throughout the site and create suitable habitats for many species of animals and birds.

When these two highways were constructed, most of the vegetation was removed between the right-of-ways for construction. These areas had to be revegetated for aesthetic and erosion control purposes. The introduction of plant materials for these purposes may cause problems by attracting wildlife to the area of the highway for foraging, damaging or killing the plant material and creating a hazard for motorists. However, unless the plants have particular appeal, wildlife will not specially be attracted to the plants within the right of way.

Potential existing vegetation

To compile a list of vegetation for the study area, the Weber-Davis soil survey (USDA, 1968) was used as the primary source. The survey divides the Weber-Davis area into nine different range sites which are determined by soil and vegetation type. Within the actual right-of-way boundaries, these vegetation types have the potential to exist, although each species may not be growing there at the present time.

Three cross sections of the right-of-way were completed for both Interstate Fifteen and Interstate Eighty-North. (Figures 8, 9, and 10) Each cross section is an example of the existing vegetation on the site at the particular location where the cross section was taken. In locations where it was difficult to stop along the interstate, the vegetation was simply referred to as grass, shrub or trees.

Interstate Fifteen. Interstate Fifteen transverses the upland sand range site which consists of partly stabilized sand dunes and lakeshore sediments. The estimated cover of forage plants for the site ranges from about 20 to 25 percent. The potential vegetation cover for the site is about 80 percent perennial grasses, 10 percent forbes and 10 percent shrubs.

According to the soil survey, the vegetation on the site is described as follows:

> The present vegetation is mainly Indian ricegrass, sand dropseed, cheatgrass brome, and scattered big sagebrush. The most important decreaser grasses on this site are needle-and-thread, Indian rice-grass, tall native bluegrass, and prairie junegrass.

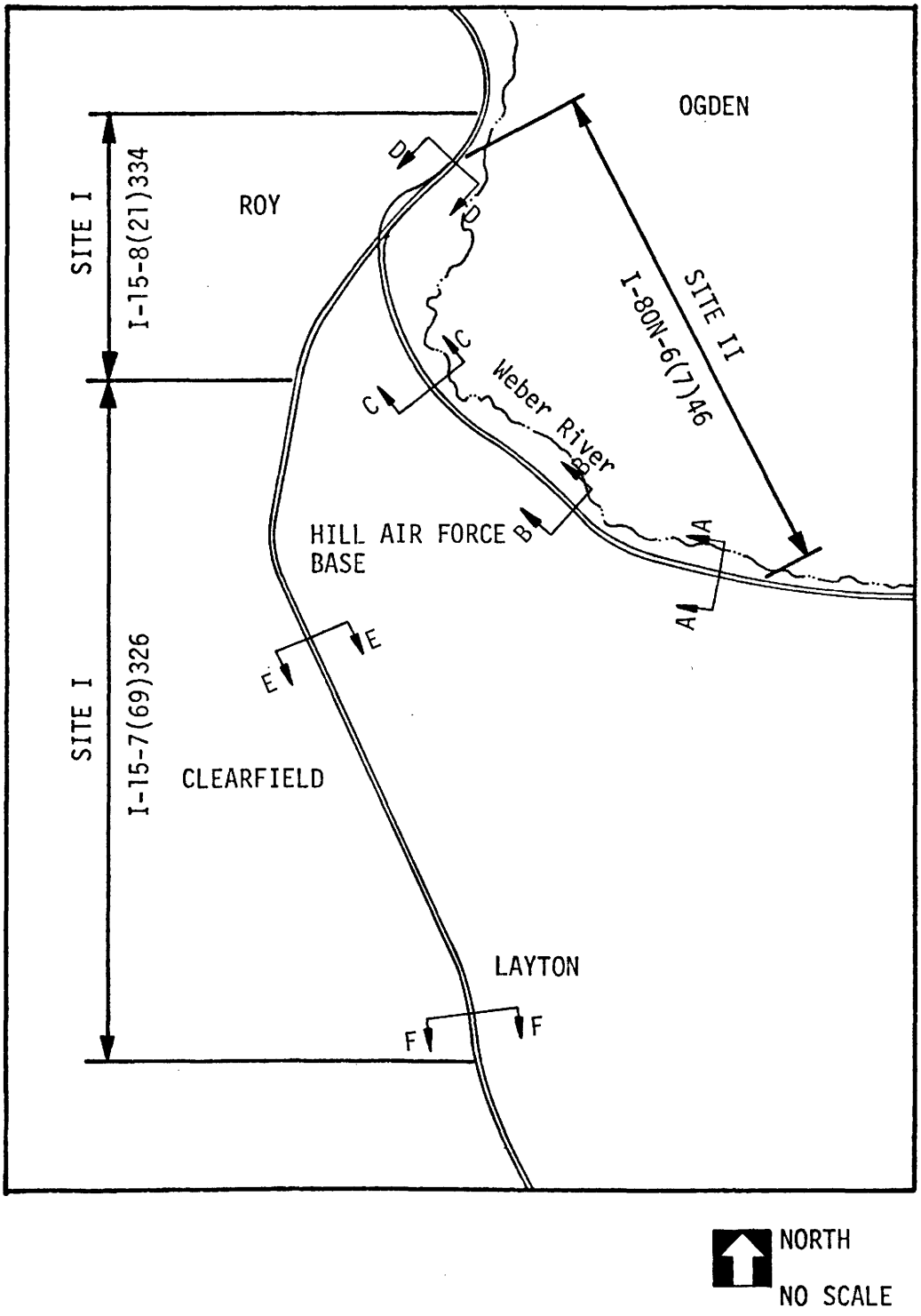


Figure 8. Location map of existing vegetation cross sections I-15 and I-80N

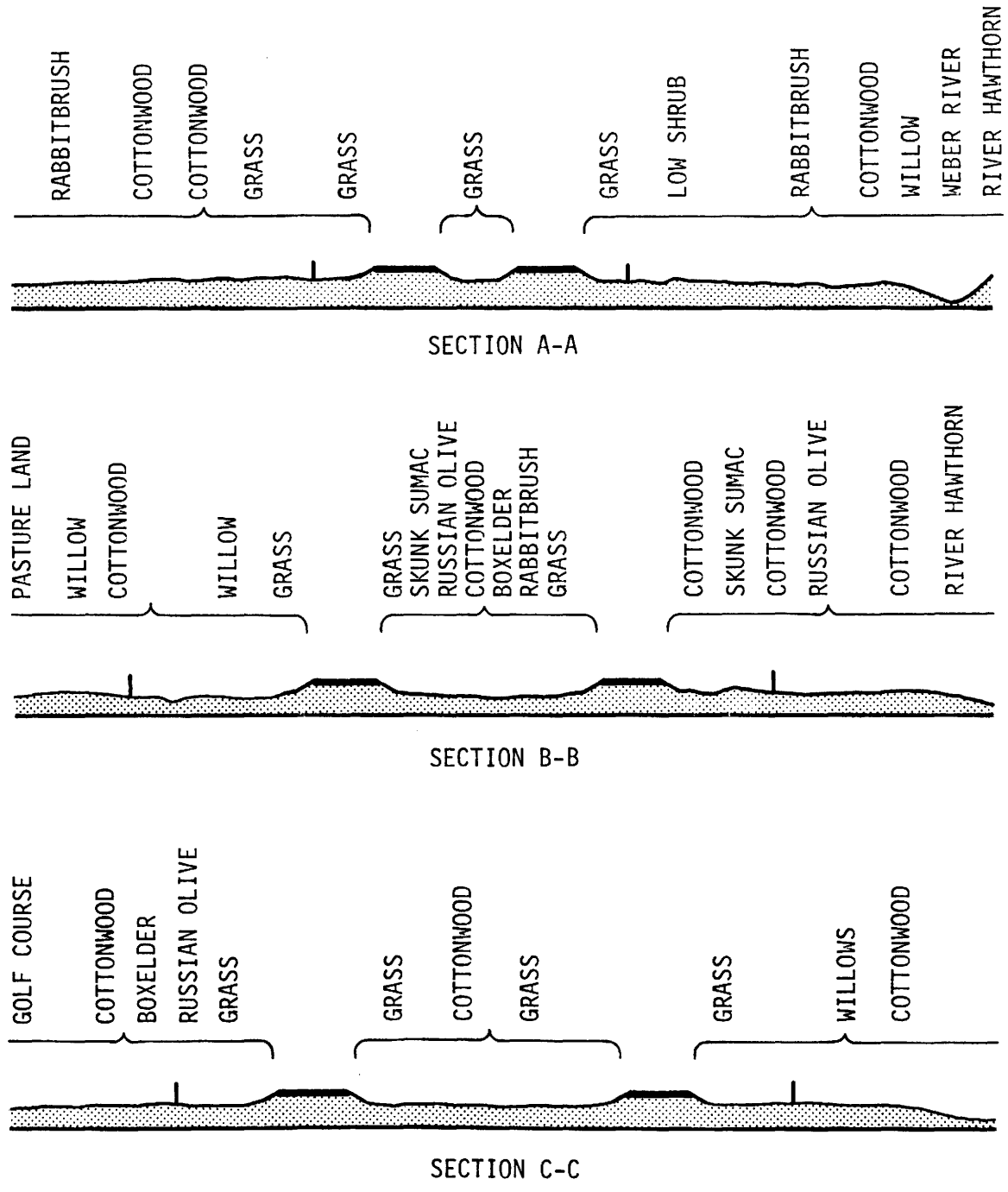


Figure 9. Existing vegetation cross sections I-80N

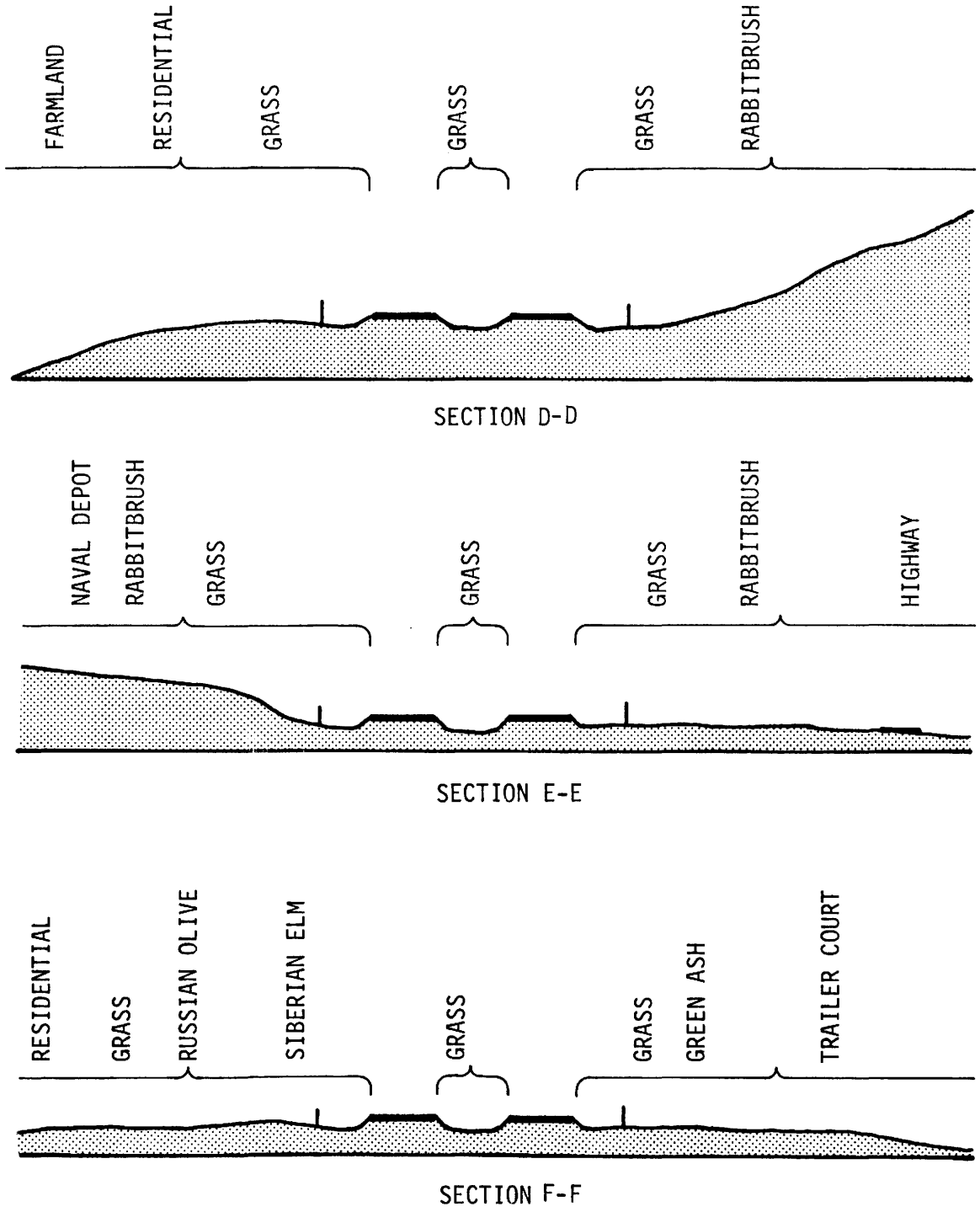


Figure 10. Existing vegetation cross sections I-15

> Dryland sedges are important increasers. Increaser grasses are sand dropseed, western wheatgrass, and three-awn. Forbs are oysterplant, penstemon, lupine sego lily, Indian paintbrush, and herbaceous sage. Important shrubs are big sagebrush, buckwheat, and brushy Gambel oak. Cheatgrass brome, rabbitbrush, annual weeds, and snakeweed are common invaders. (USDA, 1968, p. 31)

Also existing on the site were occasional clumps of Black Locusts, Poplars and Siberian Elms. Where water seepage was noted along the right-of-way, dense stands of Willows and Rushes were observed.

Interstate Eighty-North. Interstate Eighty-North transverses the semiwet meadow range site which consists of low lake terraces, alluvial fans, flood plains and low terraces along rivers. The potential vegetation cover for the site is about 85 percent perennial grasses and 15 percent weeds.

According to the soil survey, the vegetation on the site should be as follows:

> The present vegetation in this site is dominantly Kentucky bluegrass, saltgrass, cheatgrass brome, alkali-grass, and rose bushes. The Martini soil has a cover of cottonwood and boxelder trees in some places. The potential cover of vegetation that the site will support is about 85 percent perennial grasses and 15 percent weeds.
>
> Important decreaser grasses are alkali bluegrass, Great Basin wildrye, tufted hairgrass, and alpine timothy. The most important increaser grasses are western wheatgrass, Kentucky bluegrass, alkaligrass and wiregrass. Other important increasers are sedges and rushes. Forbs are deathcamas, sego lily, cinquefoil, yarrow, bullthistle, and peavine. The important shrubs are willow and rose. (USDA, 1968, p. 30).

Other plant materials adjacent to the roadway included a variety of native plants such as Skunk Brush, Redosier Dogwood and River Hawthorn.

Project Evaluation

Type of plant material

The type of plant species used by UDOT for the landscaping of the two projects included the following:

Interstate Fifteen plant material.

1. *Elaeagnus angustifolia*
2. *Fraxinus pennsylvanica lanceolata*
3. *Gleditsia triacanthos inermis*
4. *Juniperus virginiana canaertii*
5. *Koelreuteria paniculata*
6. *Pinus nigra*
7. *Platanus acerifolia*
8. *Populus canadensis*
9. *Populus nigra italica*
10. *Ulmus amerieana moline*
11. *Juniperus chinensis pfitzeriana*
12. *Rhus glabra*

Interstate Eighty-North plant material.

1. *Pinus nigra*
2. *Juniperus virginiana canaertii*
3. *Fraxinus pennsylvanica lanceolata*
4. *Populus canadensis*
5. *Rhus glabra*

Conditions of plants

During the summer months of 1976 a field survey of the study area was undertaken. The purpose of this survey was to evaluate the present condition of the projects, more specifically to determine the condition of the plant materials. The survey was done by utilizing the project landscaping plans prepared by UDOT as a guide. These plans were used to determine where the plant materials and irrigation systems had been located. The plant materials were observed by driving along the designated sites areas to verify the planting plans. Next a walking-observation study of each plant shown on the landscape plan was done to determine what percent of the original plantings had died or were stunted. In some cases the plantings, such as *Juniperus chinensis pfitzeriana* and *Rhus glabra* were observed as masses because of the difficulty of distinguishing individual plants.

To determine what percent of plant material had survived in the study area a table was developed (Table 2). This table utilized the Utah State Department of Highways estimate invoice for the two projects. These invoices provided the number and price of each required plant. The field count provided the number of existing plants. The plants were then categorized under three headings: percent living, percent stunted, and percent dead.

1. Percent living. The percent living refers to the plants which had good growth over the time period the projects have been established.

2. Percent stunted. The percent stunted were the plants which were maintaining themselves with little or no noticeable growth.

Table 2. Plant survival table

SCIENTIFIC NAME	COMMON NAME	No. of Plants Paid for	7/24/76 Field Count	% Living Plants	% Stunted Plants	% Dead Plants
Elaeagnus angustifolia	Russian Olive	310	282	91	0	9
Fraxinus pennsylvanica lanceolata	Green Ash	382	332	81	6	13
Gleditsia tricanthos inermis	Thornless Honey Locust	222	131	37	22	41
Juniperus virginiana canaertii	Cannart Juniper	560	545	92	5	3
Koelreuteria paniculata	Golden Rain Tree	66	30	26	20	54
Pinus nigra	Austrian Pine	294	268	79	12	9
Platanus acerifolia	London Plane Tree	248	127	51	0	49
Populus canadensis	Carolina Poplar	12	0	0		100
Populus nigra italica	Lombardy Poplar	10	2	2		98
Ulmus americana moline	Moline Elm	112	61	46	8	46
Juniperus chinensis pfitzeriana	Pfitzer Juniper	391				
Rhus glabra	Smooth Sumac	196				
(Project I-15-8 [21] 334 Davis-Weber County line to 31st Street Odgen) Date: June 25, 1967 (Project I-15-7 [69] 326 Layton to Davis-Weber County line)						
Pinus nigra	Austrian Pine	212	30	9	5	86
Juniperus virginiana canaertii	Cannart Juniper	240	65	21	6	73
Fraxinus pennsylvanica lanceolata	Green Ash	187	51	21	6	73
Populus canadensis	Carolina Poplar	125				
Rhus glabra	Smooth Sumac	575	169	0	29	71
(Project I-80N-6 [7] 46 Riverdale to Unitah Junction) Date: December 20, 1974						

Typically the main trunk was dead; the only visible growth being the yearly suckers growing from the roots.

3. Percent dead. The percent dead was determined by subtracting the living plants, which included those stunted, from the number of plants paid for.

After the evaluation of the plant materials in the case study area, it was noted that the existing plants could be classified into three categories, high survivability, medium survivability, and low survivability. (Table 3) These categories were determined by grouping the percent of living plants.

1. High Survivability. High survivability; 75 percent to 100 percent of the plants were in good condition. This indicates that the species represented in this category were suitable for the site and have a good chance of reaching maturity.

2. Medium Survivability. Medium survivability; 35 percent to 74 percent of the plants were in good condition. This indicates these species were not suitable, resulting in a greater number of loss.

3. Low Survivability. Low survivability was considered to be under 35 percent survival rate. Under the conditions in the study area, these species have little chance of surviving.

Factors such as irrigation and maintenance also influence survival rates and will be discussed in the following section.

The following table indicates which of the species planted are surviving under the present conditions of Interstate Fifteen. *Juniperus chinensis pfitzeriana, Elaeagnus angustifolia, Fraxinus pennsylvanica lanceolata* and *Pinus nigra* have the best survival rates. Apparently

Table 3. Plant survivability for I-15.

PLANT SURVIVABILITY FOR I-15					
HIGH	%	MEDIUM	%	LOW	%
Scientific Names	Living	Scientific Name	Living	Scientific Names	Living
Juniperus virginiana canaertii	92	Platanus acerifolia	51	Koelreuteria paniculata	26
Platanus acerifolia	91	Ulmus americana moline	47	Populus nigra italica	2
Fraxinus pennsylvanica lanceolata	81	Gleditsia triacanthos inermis	37	Populus canadensis	0
Pinus nigra	79				
These survivability rates are valid for the geographic study area of Interstate-Fifteen only and under the present maintenance practices.					

they were good choices for the site. The other species used showed that they could not survive under the existing conditions and should not be used, or used only where modifications to the growing environment are practical.

Interstate Eighty-North

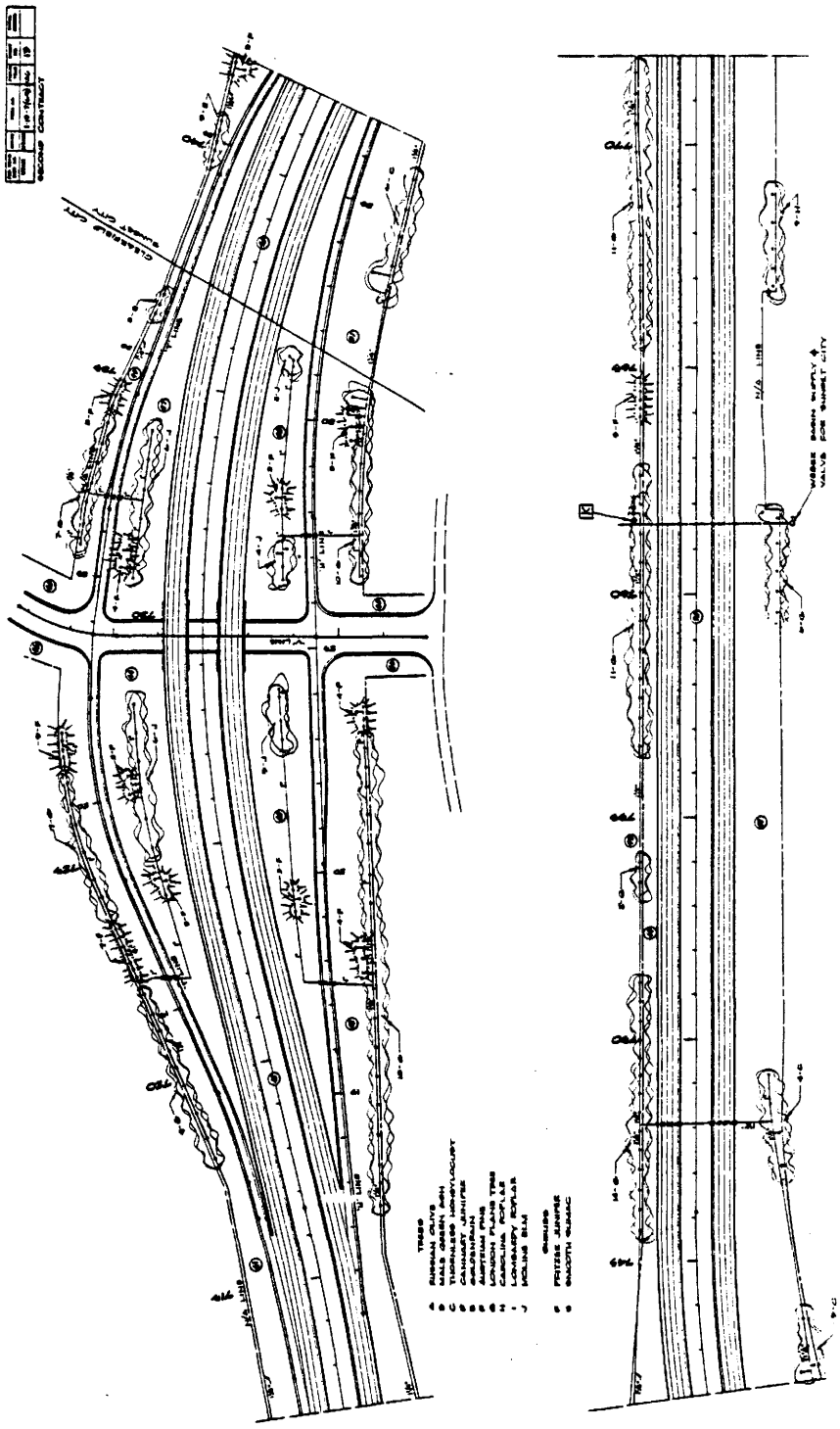
The Interstate Eighty-North count may not reflect the true survival rates. The plants that were called off on the planting plan did not relate to the site planting in all cases. Therefore, the surviving plants were counted by observing living plants regardless of location. The dead plants were counted by subtracting the number

of living plants from the number paid for. Some dead plants were actually observed, but for the most part, there was little evidence of any dead plants on the site. For this reason, all of the plants along Interstate Eighty-North showed a low survival rate. Therefore, a plant survivability table was not developed.

Location of plants

The location of plant materials in a design is an important element to be considered. The aesthetic appearance of the highway should be kept in harmony with the natural landscape. AASHTO stated that plants should be located in natural groups rather than formal geometric lines (Figure 11).

When the information from the survey was evaluated, it was evident that some plantings had been placed in undesirable and obscured locations along the right-of-way. The most frequently used configuration through the design was row planting. (Figure 12) This type of single row planting is monotonous to the motorist traveling at 55 miles per hour and does little to enhance the highway. It is also a costly type of planting requiring long lineal irrigation lines which have to be maintained if the system is to perform adequately. For these reasons, group or clump plantings may be more desirable than row plantings especially in nonurban areas. Such groupings of plants also provide group protection from the elements while creating a beneficial microclimate for their existence.



NORTH

NO SCALE

Figure 11. Section of planting plan I-15

Location of plants Interstate Fifteen

One of the problems in the planting of Interstate Fifteen, was the placement of plant materials in obscured locations. Plants were placed behind existing trees causing the new plants to be stunted or deformed. Other plants, such as *Juniperus chinensis pfitzeriana* were located behind guardrails or placed in small obscured corners created by the skew angle of the structures. In some locations the plant materials were placed out of the line-of-sight of the motorist. These plants were located at the bottom of the highway fills or along the right-of-way fence which lessened their visual significance.

Underground water seepage or springs created unique microelements at different locations along the project. (Figure 13) According to the planting plan the plants which were planted in these locations received no special consideration. For example, *Pinus nigra, Fraxinus pennsylvanica lanceolata* and *Gleditsia triacanthos inermis* were planted in these areas by UDOT. The success of these plants is generally uncertain in wet areas; they were either stunted or dead. Species *Salix* which tolerate wet conditions, could have been used. It was noted that in most of these areas, different varieties of *Salix* spp. became established naturally and are doing better than plants planted by UDOT.

Location of plants Interstate Eighty-North

Interstate Eighty-North planting was used mainly for the purpose of revegetating the Weber River channel changes. Strangely, the designers did not use a single species that was native to this area.

Figure 12. Most frequently used configuration, row planting

Figure 13. Water seepage area

The use of such species as *Fraxinus pennsylvanica lanceolata, Juniperus virginiana canaertii, Pinus nigra, Populus canadensis* and *Rhus glabra* did not blend into the natural landscape, but tended to stand out against the existing native plants. (Figure 14) Upon interviewing one of the designers of the project, it was learned that no irrigation system would be needed because of the high water table in that area. Only a ninety day period of hand watering was specified for the initial establishment of the plants.

Interstate Eighty-North had the same problems as Interstate Fifteen in the placement of plant materials. The planting plans indicated that species such as *Pinus nigra, Fraxinus pennsylvanica lanceolota* and *Populus canadensis* should be planted in the flood plain of the Weber River. During field observation of the site it was determined that none of these plants existed. Most of the planted areas along the river were being revegetated naturally by native species. Other plants were destroyed because they were located on service roads where vehicles ran over them.

Cost of plants for the projects

Cost is a very important factor in any highway planting design. Because it is important, the cost of the plants being used was determined. To accomplish this, the estimate invoice for the two projects were obtained from UDOT. The information was then presented in the following table (Table 4).

Before summarizing the two tables, it should be noted that Interstate Fifteen had a manual sprinkling system for the irrigation

Figure 14. Austrian Pine (circled) and native plants

Table 4. Projects estimate invoice

SCIENTIFIC NAME	COMMON NAME	Price $	No. of Plants Paid for	Amount $	No. of Plants Lost	Amount Lost
Elaeagnus angustifolia	Russian Olive	7.00	310	2,170.00	28	196.00
Fraxinus pennsylvanica lanceolata	Green Ash	8.00	382	3,056.00	50	400.00
Gleditsia tricanthos inermis	Thornless Honey Locust	8.00	222	1,776.00	91	728.00
Juniperus virginiana canaertii	Cannart Juniper	8.50	560	4,760.00	15	127.50
Koelreuteria paniculata	Golden Rain Tree	8.50	66	561.00	36	306.00
Pinus nigra	Austrian Pine	15.00	294	4,410.00	26	390.00
Platanus acerifolia	London Plane Tree	8.50	248	2,108.00	121	1,028.50
Populus canadensis	Carolina Poplar	7.00	12	84.00	12	84.00
Populus nigra italica	Lombardy Poplar	7.00	10	70.00	8	56.00
Ulmus americana moline	Moline Elm	8.00	112	896.00	51	408.00
Juniperus chinensis pfitzeriana	Pfitzer Juniper	7.00	391	2,737.00		
Rhus glabra	Smooth Sumac	3.00	196	588.00		
(Project I-15-8 [21] 334 Davis-Weber County line to 31st Street Odgen) (Project I-15-7 [69] 326 Layton to Davis-Weber County line)			TOTAL	23,216.00		3,724.00
Pinus nigra	Austrian Pine	19.00	212	4,028.00	182	3,458.00
Juniperus virginiana canaertii	Cannart Juniper	11.70	241	2,819.70	176	2,059.20
Fraxinus pennsylvanica lanceolata	Green Ash	15.60	185	2,886.00	134	2,090.40
Populus canadensis	Carolina Poplar	10.80	121	1,306.80		
Rhus glabra	Smooth Sumac	4.80	564	2,368.80	395	1,659.00
(Project I-80N-6 [7] 46 Riverdale to Unitah Junction)			TOTAL	13,409.30		9,266.60

of plants, while Interstate Eighty-North required only ninety days of hand watering for its plants. The tables show the price of trees and shrubs only and do not include the price of grass seeding, mulching, weed control, and irrigation systems.

The cost table shows that Interstate Fifteen had a total cost for plants of $23,216.00. It also shows a loss of $3,724.00 in plants which is 16 percent of the total cost of plants. Interstate Eighty-North had a total cost of plant materials of $13,409.30 and a loss of $9,266.60 which is 69 percent of the total cost. These figures do not include the cost of replacing dead plant materials.

Maintenance

Maintenance can be crucial to the survival of plant materials in a highway planting scheme. Landscape maintenance can be divided into two categories; irrigation and plant care. Irrigation entails getting water to the plants by hand watering, manual sprinkler irrigation systems, automatic sprinkler irrigation systems or relying on natural precipitation. Whichever method of artificial irrigation is chosen, it must be maintained and be kept in working order. Plant care includes mowing, pruning, fertilization, plant health care--disease and insect problems and other maintenance which is related to the care of plant materials.

To determine the landscape maintenance practices for the two projects, a personal interview was held with the maintenance foreman for the areas. Information was obtained for the size of the work force and nature of their work schedule.

The work force consisted of one full time employee with a part-time helper during the summer. Maintenance for the sites began the last of June and continued through to the last of September. During this period, the sprinkler system is turned on. There is no set schedule for irrigation; it is done on a rotating basis. The inspection and needed repairs for the irrigation system are done during this period of time. Mowing of the site is done two times during the summer season. Because of the cost of maintenance only the roadway shoulders and medium are mowed. This leaves the area from the mowing strip to the right-of-way fence uncut. Some weed control is done but only around guardrails and signs. The maintenance of trees and shrubs is done by the same person. As with the irrigation system, no set time or schedule was given for plant inspections.

Native vegetation

During the construction period of the two highways, most of the existing vegetation which was growing on the right-of-ways and highway shoulders was removed. This vegetation was later replaced with grasses and trees as contracted by UDOT. Within these areas, plants native to the site had regenerated and were growing better than most of the exotic material used by the UDOT.

Along Interstate Eighty-North, native plants such as *Salix* spp., *Rhus trilobata*, and *Populus angustifolia* were surviving better than the *Fraxinus pennsylvanica lanceolata* and *Rhus glabra* used by UDOT. (Figure 15 and Figure 16)

Figure 15. Smooth Sumac planted by UDOT along I-80N

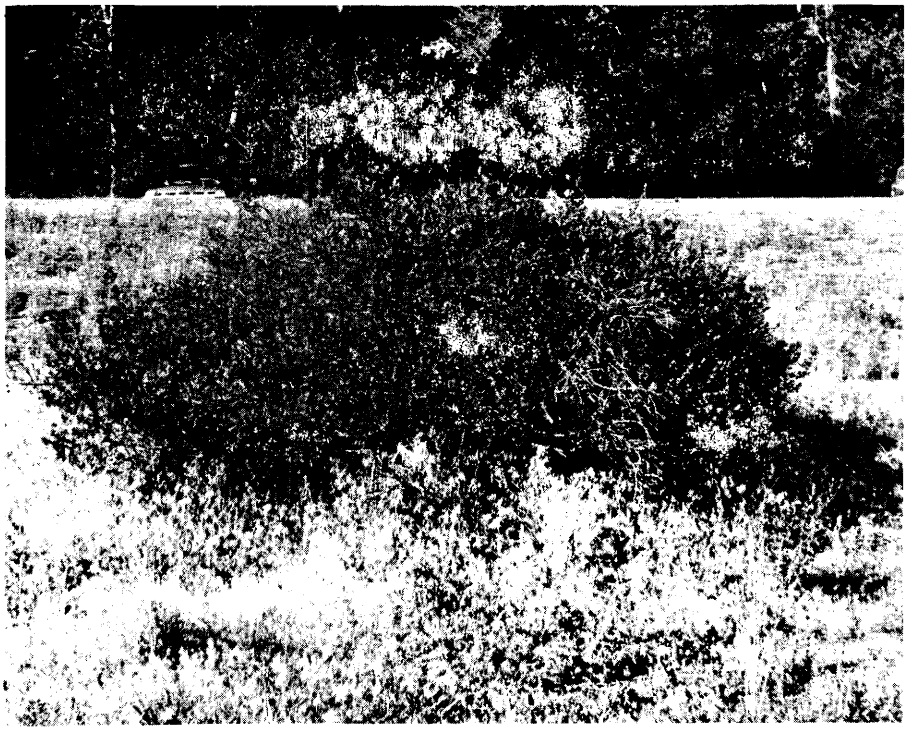


Figure 16. Skunk Sumac naturally revegetating along I-80N

On Interstate Fifteen parallel conditions occurred. Areas of water seepage provided a wet environments along sections of the highway. *Salix* spp. and *Scirpus acutus* revegetated these areas. (Figure 17 and Figure 18) *Chrysothamnus nauseosus* was originally a dominant plant on the site and not only regenerated on the highway shoulders but also in the median of the highway as well. Grasses and alfalfa from the surrounding farm land was also starting to reproduce along the highway.

All of this provides evidence that plants will exist on a certain site if the ecological conditions are suited for that species. This occurs even without the help of man.

Summary

In summary, the aesthetic appearance of Interstate Fifteen and Interstate Eighty-North should be kept in harmony with the landscapes natural surroundings. To accomplish this, the proper plants and correct placement should be considered in the design. This will assure that plants will be viewed by the public and not placed in obscured or awkward locations. Also, proper location will help to assure the plant survivability.

The survivability rate of plants which are presently being used for landscaping by UDOT is not good. With the exception of *Juniperus virginiana canaertii, Elaeagnus angustifolia, Fraxinus pennsylvanica lanceolota* and *Pinus nigra* plants used on Interstate Fifteen were below a 50 percent survivability rate.

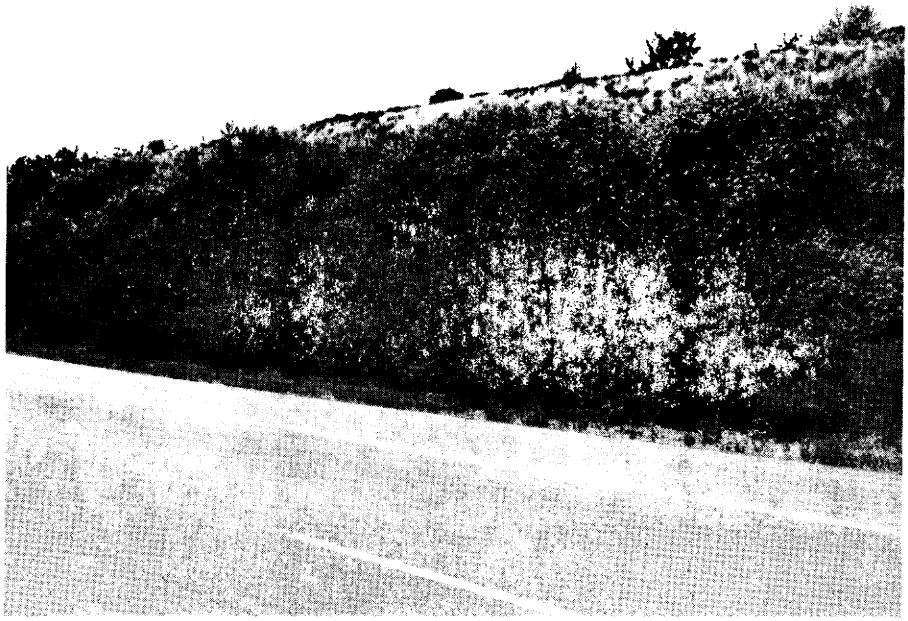


Figure 17. Water seepage or springs create unique micro-elements along I-15

Figure 18. Rabbitbrush naturally revegetating along I-15

The plants from Interstate Fifteen which showed a high survivability rate were not surviving well on Interstate Eighty-North. From a review of maintenance practices it was shown that Interstate Fifteen had a manual sprinkler system, whereas, Interstate Eighty-North had only a 90 day hand watering. Thus it can be concluded that maintenance, especially irrigation is a key factor in survivability of these particular exotic species.

From cost data gathered from this study, it was shown that there was a great variation in loss between Interstate Fifteen (16 percent) and Interstate Eighty-North (67 percent). This may be attributed to various factors such as irrigation, choice of plant materials, soils, climate and maintenance practices.

Plant Availability and Propagation

UDOT felt that the greatest reason for not using native plant materials was the lack of available native species and seeds. Since there was very little demand for native plants commercially in Utah, few species were available. Consequently, native plants were not utilized for planting. In spite of this common belief, seeds and native plants are available and can be obtained.

Native plants are being propagated by local nurseryman. If nurseryman are notified in advance of the demand for particular species, native plants could be propagated in sufficient numbers for highway planting. In a technical beautification clinic sponsored by the American Association of Nurserymen, Gilmore, a nurseryman stated:

> I for one as a wholesale nurseryman would be more than delighted if we had some indications that

> a lot of certain native plants would be used in large quantities. I am sure I speak for thousands of nurserymen who would gladly increase their production if they had an indication of what plants would be needed, and what type of material can be used and what type of material cannot be used in large quantities in any work other than in highway planting. (American Association of Nurserymen, 1967, p. 10)

A list of seed collectors and plant materials producers is given in a report prepared for the U.S. Fish and Wildlife Service (Institute for Land Rehabilitation, 1977).

Research is also being carried out on propagation of native plant material. Various state universities, highway departments, big game management bureaus and the United States Department of Agriculture are propagating and selecting native plants for revegetating purposes (Plummer, n.d.; Stark, 1966; and USDA "Highway Research Report," 1976).

Lists of Native Plants Suitable for Highway Planting

It was determined from the case study that the exotic species planted by UDOT were not surviving in the absence of an irrigation system. Survival rates were average where irrigation was provided. On both study sites native plants were revegetating naturally. This evidence indicated that native plants might be more suitable for highway planting. The following plant list, including information on plant description, use, adaptions, establishment and management is provided as an alternative to the exotic species presently being used by UDOT.

To prepare such a list, pertinent information pertaining to the survival of native plants had to be researched. Information on climatic zones for Utah and environmental factors which affect plants were studied. To accomplish this the following was completed:

1. Climatic zones were determined for Utah and mapped by using geographic regions, elevation, precipitation and vegetation types as the criteria; these maps and zone descriptions were presented in the Review of Literature;

2. Environmental factors which influence plant survival, such as radiation, temperature, precipitation, wind, and soil, were discussed in the Review of Literature;

3. Information peculiar to highways which affect plant growth, such as disturbed soils, highway cuts and fills, road surface heat, salts and exhaust fumes was compiled in the Review of Literature;

4. Criteria set by the American Association of State Highway Transportation Officials regarding highway planting was summarized in the Review of Literature.

A list of plants native to the state of Utah was developed. These species were studied for their potential use for highway planting. The following criteria were used to determine which plants would be included in the final plant list.

1. The species must be native to Utah;

2. The species had to grow within the elevation range where highways might be constructed, e.g., plants which grow in extremely high elevations were not included;

3. Species with weed characteristics such as, unduly spreading rootstocks, rhizomes and seeds, were eliminated;

4. Poisonous characteristics were given special consideration;

5. This list of potential species to be included was reviewed by range and botany specialists and their suggestions were incorporated in the formulation of the final list.

A final list of suitable native plants for highway planting was compiled. The information on environmental factors and problems peculiar to highways, was utilized to develop the plant list form. The form was developed to include information pertaining to plants description, use, adaptions, establishment and management. (See Appendix B) The following information was included:

1. Description: scientific name; common name; type; ultimate height; ultimate spread; form; texture; twigs; bark; leaf description; leaf color; flower time; fruit; root type; life span; poisonous.

2. Use: best use; palatability.

3. Adaptions: elevation and topography; range sites; exposure; drought tolerance; wind firm; aspect; soil--texture, pH, depth, moisture organic matter, drainage.

4. Establishment: transplantability; planting time.

5. Management: maintenance; insects; diseases.

A matrix to summarize the pertinent information on each species was developed. (See Appendix C.)

PLANT LIST

SCIENTIFIC NAME: Abies concolor COMMON NAME: White Fir

TYPE:	Evergreen tree
ULTIMATE HEIGHT:	100-120' (30-36m)
ULTIMATE SPREAD:	25-30' (7-9m)
FORM:	Pyramidal, dense, rounded with age; crown is conical shaped
TEXTURE:	Medium
TWIGS:	Smooth, yellow-green to gray-brown
BARK:	Young bark gray, older gray to reddish-brown, deeply furrowed, resin blisters
LEAF DESCRIPTION:	Needle-like, flattened, blunt and flexible, 2½" long on lower branches, 1¼" long near top
LEAF COLOR:	Silver-green, gray-green
FLOWER COLOR:	Large green upright cones
FLOWER TIME:	May - June
FRUIT:	4" cone, small, upright green to brown, mature early September, deciduous after frost
ROOT TYPE:	Shallow, spreading, fibrous
LIFE SPAN:	Long-lived (300 years)
POISONOUS:	Not poisonous

USE

BEST USE:	Screen specimen: Erosion control for watershed protection
PALATABILITY:	Heavy porcupine damage

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	5,000-10,000 ft., mid-elevation canyon bottoms and north slope, deep moist soils
RANGE SITES:	In Utah sparse, most abundant in moist canyon bottoms of central area of State
EXPOSURE:	Tolerant of shade in youth, but will take sun
DROUGHT TOLERANCE:	Moderate to good, if well-established
WIND FIRM:	Subject to wind throw if mature stand is thinned
ASPECT:	North, northwest, benches and bottoms
SOIL:	

TEXTURE:	Loams
pH:	5.5 - 7.0
DEPTH:	Deep
MOISTURE:	Well drained, moist soils - will do well on poor, drier sites
ORGANIC MATTER:	Moderate to high
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good when young to 15' (5m)
PLANTING TIME:	March - April

MANAGEMENT

MAINTENANCE:	Little maintenance, clean
INSECTS:	19+ on species, scolytis SSA are damaging to young and old trees
DISEASES:	24+ on species, subject to heavy dwarf mistletoe damage, heart rot

PLANT LIST

SCIENTIFIC NAME: Abies lasiocarpa COMMON NAME: Subalpine Fir

TYPE:	Evergreen trees
ULTIMATE HEIGHT:	80-90' (24-27m)
ULTIMATE SPREAD:	21-27' (6-8m)
FORM:	Narrowly pyramidal, spirelike
TEXTURE:	Medium
TWIGS:	Smooth with small inconspicuous leaf scars
BARK:	Gray, smooth when young, fissured when older, resin blisters
LEAF DESCRIPTION:	Flattened needles, blunt on ends or notched, ascending needles
LEAF COLOR:	Blue green, evergreen
FLOWER COLOR:	Inconspicuous
FLOWER TIME:	Summer
FRUIT:	Ovulate cones, purplish, deciduous
ROOT TYPE:	Shallow, spreading laterals
LIFE SPAN:	Moderate to long
POISONOUS	Not poisonous

USE

BEST USE:	Screen, windbreak, ornamental use: Erosion Control for Watershed Protection
PALATABILITY:	Grouse, sheep, deer, squirrels

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	4,600 to 11,000', cool moist sites at high elevations, abundance at timber line
RANGE SITES:	Information not available
EXPOSURE:	Shade tolerant in youth, sun in age
DROUGHT TOLERANCE:	Poor
WIND FIRM:	Good in groups, poor in thinned matured stands
ASPECT:	North at lower elevations
SOIL:	Soil moisture is important, can encroach on swampy land if soil is not too heavy

TEXTURE:	Rocky to medium
pH:	5.5 - 7.0
DEPTH:	Shallow or deep loose soils
MOISTURE:	Moist
ORGANIC MATTER:	High
DRAINAGE:	Well drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good when young, to 15' (5m), larger trees subject to shock
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Little maintenance, clean
INSECTS:	6 on species
DISEASES:	Many on genus - wood rot

PLANT LIST

SCIENTIFIC NAME: Acer glabrum COMMON NAME: Rocky Mountain Maple

TYPE:	Deciduous trees
ULTIMATE HEIGHT:	25' (7.5m)
ULTIMATE SPREAD:	15' (4.5m)
FORM:	Rounded shrub to small tree, rather delicate-looking
TEXTURE:	Medium
TWIGS:	Red stems, smooth, red-brown, and rounded in cross-section
BARK:	Smooth in youth, brown-gray, fissured in age
LEAF DESCRIPTION:	3-5 lobed or parted margins doubly serrated, 3½" in diameter, glabrous
LEAF COLOR:	Green, pale below summer, pale yellow, reddish orange Autumn
FLOWER COLOR:	Monoecious, decidious, inconspicuous, greenish-yellow
FLOWER TIME:	Early spring
FRUIT:	Double samara, green summer, yellow and red Autumn, conspicuous
ROOT TYPE:	Fibrous spreading
LIFE SPAN:	Moderate, rapid growth rate
POISONOUS:	Not poisonous

USE

BEST USE:	Tall ornamental shrub; can be used for erosion control
PALATABILITY:	Deer browse

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	6,000-9,000', found in moist deep soils and along canyon bottoms
RANGE SITES:	Found throughout Utah especially central, north and eastern mountain ranges
EXPOSURE:	Sun or shade
DROUGHT TOLERANCE:	Poor to fair
WIND FIRM:	Yes
ASPECT:	North, streamside
SOIL:	

TEXTURE:	Medium, rocky and gravelly
pH:	6.0 - 7.0
DEPTH:	Deep
MOISTURE:	Moist-dry
ORGANIC MATTER:	Yes, if possible
DRAINAGE:	Well drained

ESTABLISHMENT

TRANSPLANTABILITY:	Poor with wildlings
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Little maintenance, prune if desired, clean
INSECTS:	49 on genus
DISEASES:	7 on species

PLANT LIST

SCIENTIFIC NAME: Acer grandidentatum COMMON NAME: Bigtooth Maple

TYPE:	Deciduous Trees
ULTIMATE HEIGHT:	30-40' (9-12m)
ULTIMATE SPREAD:	Tree to 25' (7.5m)
FORM:	Tree or shrub, several branched shrub, rounded, spreading ascending branches
TEXTURE:	Medium to course
TWIGS:	Round and reddish to brown, later gray
BARK:	Grayish, flat-topped ridge on mature bark, plate-like scales
LEAF DESCRIPTION:	3.5" lobed, rounded lobes, 4" in diameter, broad as high
LEAF COLOR:	Dark green, Summer, red, yellow, orange, Autumn
FLOWER COLOR:	Light-green, inconspicuous
FLOWER TIME:	Early spring, April or May
FRUIT:	1" samara, reddish tan summer, green at maturity
ROOT TYPE:	Spreading, shallow
LIFE SPAN:	Moderate, slow growth rate
POISONOUS:	Not poisonous

USE

BEST USE:	Hedge, specimen, shrub mass/screen, occasionally used for sugar
PALATABILITY:	Deer browse

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	4,500-7,500', canyon bottoms, draws and moist mountain sites
RANGE SITES:	Common in the central plateau and mountain region of Utah
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Fair to good
WIND FIRM:	Yes
ASPECT:	South at higher elevations, all aspects at lower elevation
SOIL:	

TEXTURE:	Rocky to medium
pH:	6.0 - 8.0
DEPTH:	Deep to shallow
MOISTURE:	Moist to dry
ORGANIC MATTER:	Yes, if possible
DRAINAGE:	Must be well drained

ESTABLISHMENT

TRANSPLANTABILITY:	Poor on established wildlings
PLANTING TIME:	Information not available

MANAGEMENT

MAINTENANCE:	Poorly branched trunks may split, clean
INSECTS:	49 on genus
DISEASES:	8 on species

PLANT LIST

SCIENTIFIC NAME: Acer negundo COMMON NAME: Boxelder

TYPE:	Deciduous trees
ULTIMATE HEIGHT:	65' (19.6m)
ULTIMATE SPREAD:	25-30' (7.5-9m)
FORM:	Irregular tree; broadly, densely round, usually extending from the ground up
TEXTURE:	Medium
TWIGS:	Relatively stout, greenish and somewhat hairy
BARK:	Light gray, narrowly furrowed, light brown, gnarled trunks
LEAF DESCRIPTION:	Compound or tripinately compound, 3 lobed, leaflets oblong, acuminate coarsely toothed
LEAF COLOR:	Dull green summer, yellow autumn
FLOWER COLOR:	Yellow-green, reddish, nearly inconspicuous
FLOWER TIME:	Spring - March to May
FRUIT:	1" red samara, autumn; brown in autumn
ROOT TYPE:	Shallow to deep spreading
LIFE SPAN:	Short, rapid growth
POISONOUS:	Not poisonous

USE

BEST USE:	Rapid shade
PALATABILITY:	Birds, squirrels, deer

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	4,000-8,000', common along streams in the mountain canyons of the State
RANGE SITES:	Common to Utah
EXPOSURE:	Sun, partial shade
DROUGHT TOLERANCE:	Good if well established
WIND FIRM:	Yes
ASPECT:	Stream bottoms
SOIL:	Wide variety of soils

TEXTURE:	Medium to rocky
pH:	6.5 - 7.5
DEPTH:	Deep
MOISTURE:	Moist to dry
ORGANIC MATTER:	If possible
DRAINAGE:	Well-drained, standing water for short periods

ESTABLISHMENT

TRANSPLANTABILITY:	Readily transplanted when young
PLANTING TIME:	Seed in Autumn

MANAGEMENT

MAINTENANCE:	Limb breakage, suckering, clean
INSECTS:	49 on genus
DISEASES:	32 on species, heart rot

PLANT LIST

SCIENTIFIC NAME: Alnus tenuifolia COMMON NAME: Thinleaf Alder

TYPE:	Deciduous trees
ULTIMATE HEIGHT:	30' (9m)
ULTIMATE SPREAD:	Tree 15' (4.5m)
FORM:	Small tree or shrub, ascending limbs, shrubby, rounded, in clumps
TEXTURE:	Medium
TWIGS:	Slender, reddish in color and marked with lenticles and leaf scars when young
BARK:	Thin, reddish, horizontal lenticles, scaly, smooth, gray or red-brown
LEAF DESCRIPTION:	Ovate, doubly serrate 3" long, coarse-toothed, fine-serrate pubescent to glabrate
LEAF COLOR:	Yellow-green, dark green, dull green, Summer, yellowish-green Autumn
FLOWER COLOR:	Small inconspicuous "strobiles," pinkish, catkins 2"
FLOWER TIME:	Spring - March, April
FRUIT:	Small, "cone-like" dark, brown
ROOT TYPE:	Fibrous, shallow, nitrogen-fixing from root nodules
LIFE SPAN:	Short, rapid growth
POISONOUS:	Not poisonous

USE

BEST USE:	Barrier screen, streambank protection, shade for wildlife and fish
PALATABILITY:	Deer, sheep, beaver, elk, browsing animals

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	5,000-8,500', common on the banks of mountain streams
RANGE SITES:	Abundant in the northern part of the state
EXPOSURE:	Shade when young, sun when mature
DROUGHT TOLERANCE:	Poor
WIND FIRM:	Yes
ASPECT:	Northwest, stream bottoms
SOIL:	

TEXTURE:	Medium, black loam
pH:	6.0 - 7.0
DEPTH:	Deep to moderately deep
MOISTURE:	Moist to wet
ORGANIC MATTER:	High
DRAINAGE:	Well-drained with periods of standing water

ESTABLISHMENT

TRANSPLANTABILITY:	Good when young
PLANTING TIME:	Information not available

MANAGEMENT

MAINTENANCE:	Limb breakage, clean, train to small tree
INSECTS:	3 on species, leaves often badly chewed by insects
DISEASES:	27 on species

PLANT LIST

SCIENTIFIC NAME: Amelanchier alnifolia COMMON NAME: Saskatoon Serviceberry

TYPE:	Deciduous trees
ULTIMATE HEIGHT:	18-21' (5.5-6.4m)
ULTIMATE HEIGHT:	10-15' (3-4.5m)
FORM:	Small tree or shrub; open oblong crown; ascending branches
TEXTURE:	Medium to fine
TWIGS:	Round, rather coarse, and somewhat covered with tiny hairs
BARK:	Bronze, smooth, light brown, smooth to furrowed
LEAF DESCRIPTION:	Oval to suborbicular, pubescent veins, round base, serrate, 1½-2½ long, 1-1½ wide
LEAF COLOR:	Summer, green, young leaves bronze, Autumn, yellow to dusty red; orange
FLOWER COLOR:	White, on racemes, showy
FLOWER TIME:	Spring-April - May
FRUIT:	Small, black or purple berry - late summer, fall
ROOT TYPE:	Deep, spreading fibrous; stoloniferous, suckering
LIFE SPAN:	Moderate, slow growth rate
POISONOUS:	Not poisonous

USE

BEST USE:	Flowering shrub
PALATABILITY:	Birds, deer browse, cattle, sheep, high palatability

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	4,000-8,000', found on dry rocky slopes in full sunlight and along streams
RANGE SITES:	Widely scattered throughout the state, most common in arid areas in canyons, rocky areas, and foothills
EXPOSURE:	Sun or shade when young, Sun
DROUGHT TOLERANCE:	Moderate, if well-established
WIND FIRM:	Yes
ASPECT:	South, west, east
SOIL:	

TEXTURE:	Medium
pH:	6.0 - 7.0
DEPTH:	Deep
MOISTURE:	Moist
ORGANIC MATTER:	Yes, if possible
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Difficult
PLANTING TIME:	Information not available

MANAGEMENT

MAINTENANCE:	Suckers, clean
INSECTS:	2 on genus
DISEASES:	48 on genus - alternate best for cedar apple rust

PLANT LIST

SCIENTIFIC NAME: Amelanchier utahensis COMMON NAME: Serviceberry

TYPE:	Deciduous trees
ULTIMATE HEIGHT:	9-12' (2.7-3.6m)
ULTIMATE SPREAD:	10-15' (3-4.5m)
FORM:	Shrub, round top, much-branched
TEXTURE:	Medium
TWIGS:	Round, rather coarse, somewhat covered with tiny hairs
BARK:	Smooth, grayish
LEAF DESCRIPTION:	2" ovate leaves, rounded or acute tip, surfaces hairy, serrate margins
LEAF COLOR:	Lightgreen, summer; brown, autumn
FLOWER COLOR:	White, racemes, showy
FLOWER TIME:	May - June
FRUIT:	1/2" berrylike pome, purple black, sweet and palatable
ROOT TYPE:	Deep, spreading, stoloniferous, suckering
LIFE SPAN:	Moderate
POISONOUS:	Not poisonous

USE

BEST USE:	Ornamental shrub, background mass
PALATABILITY:	Birds, deer, good forage value

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	4,000-8,000', arid areas in canyons, rock area and foothills
RANGE SITES:	Widely scattered throughout Utah
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good, if well established
WIND FIRM:	Yes
ASPECT:	South, west, east, hillsides
SOIL:	Loam, stony, alluvial

TEXTURE:	Coarse to medium
pH:	6.5 - 7.5
DEPTH:	Moderate
MOISTURE:	Dry - annual precipitation 8-14"
ORGANIC MATTER:	Moderate
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Difficult
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Suckers, clean
INSECTS:	2 on genus
DISEASES:	48 on genus, alternate host for apple cedar rust

PLANT LIST

SCIENTIFIC NAME: Arctostaphylos patula COMMON NAME: Greenleaf Manzanita

TYPE:	Evergreen shrub
ULTIMATE HEIGHT:	6' (1.8m)
ULTIMATE SPREAD:	10' (3m)
FORM:	Rounded crown, usually symmetrical, many ascended branches, prostrate to erect
TEXTURE:	Medium-fine
TWIGS:	Crooked, reddish to brown
BARK:	Dark red, purple, smooth
LEAF DESCRIPTION:	Leathery, orbicular 1-2", glabrous
LEAF COLOR:	Green in summer, evergreen autumn
FLOWER COLOR:	White, pale pink, and rose dense 1 1/2 panicles showy
FLOWER TIME:	April - June
FRUIT:	Globose drupe, dark brown or black, glossy, edible
ROOT TYPE:	Deep
LIFE SPAN:	Moderate
POISONOUS:	Not poisonous

USE

BEST USE:	Broadleaf evergreen for low hedge, showy blossom; occasionally used for erosion control, needs water
PALATABILITY:	Deer, blue grouse, goats

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	2,000-9,000', gravelly and rocky slopes
RANGE SITES:	Southern Wasatch Range
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FORM:	Yes
ASPECT:	Flat south
SOIL:	

TEXTURE:	Coarse
pH:	5.0 - 6.0
DEPTH:	Moderate 12-37"
MOISTURE:	Less than 20" annual precipitation
ORGANIC MATTER:	No
DRAINAGE:	Well-drained, dry slopes

ESTABLISHMENT

TRANSPLANTABILITY:	Poor
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Clean, carefree
INSECTS:	25 on genus
DISEASES:	5 on species

PLANT LIST

SCIENTIFIC NAME: Artemisia filifolia COMMON NAME: Sand Sagebrush

TYPE:	Evergreen shrub
ULTIMATE HEIGHT:	1-4' (.3-1.2m)
ULTIMATE SPREAD:	Information not available
FORM:	Shrub, stems many branched
TEXTURE:	Fine
TWIGS:	Information not available
BARK:	Information not available
LEAF DESCRIPTION:	Threadlike, entire or 3-parted
LEAF COLOR:	Bluish-green
FLOWER COLOR:	Yellow
FLOWER TIME:	August to November
FRUIT:	Small, dry, 1-seeded
ROOT TYPE:	Information not available
LIFE SPAN:	Information not available
POISONOUS:	Not poisonous

USE

BEST USE:	Could be used for roadside recreation plantings, good wind erosion control for sandy areas
PALATABILITY:	Very little grazing by livestock and wildlife

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	3,000-5,000', dune lands and benches
RANGE SITES:	Mostly found in southern Utah
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good, 5 to 10" precipitation
WIND FIRM:	Information not available
ASPECT:	Information not available
SOIL:	

TEXTURE:	Sandy or coarse
pH:	Information not available
DEPTH:	Information not available
MOISTURE:	Dry
ORGANIC MATTER:	No
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Information not available
PLANTING TIME:	Information not available

MANAGEMENT

MAINTENANCE:	Carefree, clean, a weed on rangelands
INSECTS:	Information not available
DISEASES:	Information not available

PLANT LIST

SCIENTIFIC NAME: Artemisia frigida COMMON NAME: Fringed Sagebrush

TYPE:	Evergreen shrub
ULTIMATE HEIGHT:	4-14" (10-35cm)
ULTIMATE SPREAD:	1' (.3m)
FORM:	Woody and branching at base, mat-like
TEXTURE:	Fine
TWIGS:	Tomentose stems, white
BARK:	White
LEAF DESCRIPTION:	White, tomentose, pinnatifed to linear
LEAF COLOR:	White, silver-gray, summer Evergreen autumn (aromatic)
FLOWER COLOR:	Inconspicuous, yellow
FLOWER TIME:	Inconspicuous, summer, august
FRUIT:	Inconspicuous achenes
ROOT TYPE:	Fibrous
LIFE SPAN:	Short
POISONOUS:	Not poisonous

USE

BEST USE:	Borders, color accent, stabilize gullies
PALATABILITY:	Sage Grouse, broused by deer, elk, cattle, sheep

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	4,500-10,000', information not available
RANGE SITES:	Information not available
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Moderate to good
WIND FIRM:	Yes
ASPECT:	All
SOIL:	

TEXTURE:	Fine to coarse, sandy soil, dry granite, rocky ridges
pH:	7.0
DEPTH:	Shallow to deep
MOISTURE:	Dry
ORGANIC MATTER:	No
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Clean, carefree
INSECTS:	21 on genus
DISEASES:	2 on species

PLANT LIST

SCIENTIFIC NAME: Artemisia nova COMMON NAME: Black Sagebrush

TYPE:	Evergreen shrub
ULTIMATE HEIGHT:	4-16" (10-40cm)
ULTIMATE SPREAD:	1-2' (.3-.6m)
FORM:	Low, spreading shrub
TEXTURE:	Fine
TWIGS:	Densely canescent or later glabrate, erect and stiff
BARK:	Light to dark brown, shreddy
LEAF DESCRIPTION:	Small 3/4" 3-lobed ends, revolute margins, glabrous
LEAF COLOR:	Gray green, or green summer, evergreen
FLOWER COLOR:	Yellow, inconspicuous
FLOWER TIME:	Late summer
FRUIT:	Small, inconspicuous achene
ROOT TYPE:	Deep spreading
LIFE SPAN:	Short
POISONOUS:	Not poisonous

USE

BEST USE:	Border, color accent, possible ornamental planting
PALATABILITY:	Antelope, deer browse, sheep, cattle

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	4,000-8,000', dry rocky ridges
RANGE SITES:	Desert and semidesert areas, mountains and plateaus
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	South at higher elevations
SOIL:	

TEXTURE:	Coarse to rocky
pH:	6.5 - 7.5
DEPTH:	Shallow
MOISTURE:	Dry
ORGANIC MATTER:	No
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Readily transplants, wildings
PLANTING TIME:	Seed in spring

MANAGEMENT

MAINTENANCE:	Clean, carefree
INSECTS:	9 on species
DISEASES:	30 on genus

PLANT LIST

SCIENTIFIC NAME: Artemisia tridentata COMMON NAME: Big Sagebrush

TYPE:	Evergreen shrub
ULTIMATE HEIGHT:	3-12' (1-3.6m)
ULTIMATE SPREAD:	5-8' (1.5-2.4m)
FORM:	Round, compact, much-branching shrub
TEXTURE:	Fine
TWIGS:	Stout
BARK:	Twisted, gray brown, scaly, shaggy, shredding
LEAF DESCRIPTION:	Elongated with 3 lobes at tip 3/4" long, aromatic, silvery pubescence on upper and lower sides of leaf
LEAF COLOR	Silver green, whitish green summer, whitish green autumn
FLOWER COLOR:	Inconspicuous yellow
FLOWER TIME:	July - November
FRUIT:	Achene
ROOT TYPE:	Deep, spreading
LIFE SPAN:	Short to moderate
POISONOUS:	Not poisonous

USE

BEST USE:	Dry, ornamental, erosion control, stabilizing gullies
PALATABILITY:	Deer broused

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	1,500-10,600', information not available
RANGE SITES:	Information not available
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	All, south at higher elevations
SOIL:	

TEXTURE:	Coarse to fine
pH:	6.5 - 7.5
DEPTH:	Moderate; deep
MOISTURE:	Dry 8" precipitation
ORGANIC MATTER:	No
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Young plants transplant easily, wildings and seedlings
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Clean, carefree
INSECTS:	9 on genus
DISEASES:	33 for genus

PLANT LIST

SCIENTIFIC NAME: Atriplex canescens COMMON NAME: Fourwing Saltbrush

TYPE:	Evergreen shrub
ULTIMATE HEIGHT:	2-6' (.6-1.8m)
ULTIMATE SPREAD:	Information not available
FORM:	Spreading or ascending terete branches
TEXTURE:	Fine
TWIGS:	Stout, gray-scurfy branches
BARK:	Grayish, scurfy
LEAF DESCRIPTION:	Evergreen, scurfy-canescent, narrowly oblong 1/2 to 2"
LEAF COLOR:	Gray
FLOWER COLOR:	Inconspicuous, grayish green
FLOWER TIME:	June - August
FRUIT:	Achene, gray
ROOT TYPE:	Deep, extensive
LIFE SPAN:	Information not available
POISONOUS:	May poison stock, selenium

USE

BEST USE:	Possible ornamental or screening plant, mine spoils, good adaptation for erosion control
PALATABILITY:	Sheep, goats, deer, quail, rabbits, squirrel

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	Below 7,000', dry slopes, flats, washes, valley bottoms
RANGE SITES:	Northern salt desert
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	Information not available
SOIL:	

TEXTURE:	Sandy-loam
pH:	Alk. high tolerance, Sal. less frequent in subsaline
DEPTH:	Deep
MOISTURE:	Dry, under 6-10" precipitation
ORGANIC MATTER:	Information not available
DRAINAGE:	Information not available

ESTABLISHMENT

TRANSPLANTABILITY:	Not successful
PLANTING TIME:	Spring, early summer

MANAGEMENT

MAINTENANCE:	Clean
INSECTS:	None
DISEASES:	14 for genus

PLANT LIST

SCIENTIFIC NAME: Atriplex confertifolia COMMON NAME: Shadscale

TYPE:	Evergreen shrubs
ULTIMATE HEIGHT:	3' (1m)
ULTIMATE SPREAD:	4' (1.2m)
FORM:	Rounded top, erect ascending branches, spiney
TEXTURE:	Fine
TWIGS:	Scurfy branchlets
BARK:	Information not available
LEAF DESCRIPTION:	1/2" rounded, clumped together
LEAF COLOR:	Light green, gray summer, gray autumn
FLOWER COLOR:	Inconspicuous
FLOWER TIME:	April - July
FRUIT:	Achene, semishowy, tan
ROOT TYPE:	Deep, wide-spreading
LIFE SPAN:	Short
POISONOUS:	Not poisonous

USE

BEST USE:	Shrub for alkaline conditions, good barriers
PALATABILITY:	Browse, birds, sheep

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	Below 7,000', information not available
RANGE SITES:	Information not available
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	All, especially flat or south
SOIL:	

TEXTURE:	Medium to fine
pH:	7.5 - 9.0
DEPTH:	Deep to moderate
MOISTURE:	Dry 4-8" annual precipitation
ORGANIC MATTER:	No
DRAINAGE:	Well drained, some periods of standing water

ESTABLISHMENT

TRANSPLANTABILITY:	Good when young
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Clean, carefree
INSECTS:	11 on genus
DISEASES:	14 on genus

PLANT LIST

SCIENTIFIC NAME: Atriplex nuttallii COMMON NAME: Nuttall Saltbrush

TYPE:	Evergreen shrub
ULTIMATE HEIGHT:	3' (1m)
ULTIMATE SPREAD:	3' (1m)
FORM:	Rounded much-branched, shrub, spreading or ascending
TEXTURE:	Medium
TWIGS:	Stout and erect
BARK:	Scurfy
LEAF DESCRIPTION:	Rounded, oblong 2" scurfy
LEAF COLOR:	Whitish, summer, silver gray autumn
FLOWER COLOR:	Inconspicuous
FLOWER TIME:	June - August
FRUIT:	Winged achene, tan
ROOT TYPE:	Deep spreading
LIFE SPAN:	Short
POISONOUS:	May poison stock, selenium

USE

BEST USE:	Shrub
PALATABILITY:	Birds, browse

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	4,000-5,000', dry hills
RANGE SITES:	Information not available
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Yes
WIND FIRM:	Yes
ASPECT:	All
SOIL:	Slight salt tolerance

TEXTURE:	Medium to coarse
pH:	7.5 - 8.5
DEPTH:	36 - 60"
MOISTURE:	4-10" annual precipitation
ORGANIC MATTER:	No
DRAINAGE:	Well drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good when young
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Clean, carefree
INSECTS:	11 on genus
DISEASES:	14 on genus

PLANT LIST

SCIENTIFIC NAME: Berberis fremontii COMMON NAME: Fremont Mahonia

TYPE:	Evergreen shrub
ULTIMATE HEIGHT:	3-6.5' (1-2m)
ULTIMATE SPREAD:	Information not available
FORM:	Stiff, erect branches
TEXTURE:	Medium
TWIGS:	Information not available
BARK:	Gray
LEAF DESCRIPTION:	Glaucous, holly-like, leathery, spiny
LEAF COLOR:	Blue green, below, pale gray-green
FLOWER COLOR:	Purple
FLOWER TIME:	May - June
FRUIT:	Light-yellow to red, dry berry
ROOT TYPE:	Information not available
LIFE SPAN:	Information not available
POISONOUS:	Not poisonous

USE

BEST USE:	Information not available
PALATABILITY:	Some wildlife value

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	3,000-5,000', dry, rocky places
RANGE SITES:	Southwestern part of Utah, Washington County
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good, tolerant of arid soil and air
WIND FIRM:	Information not available
ASPECT:	North slopes and flats
SOIL:	Rocky, dry, decomposed granite

TEXTURE:	Coarse
pH:	Information not available
DEPTH:	Information not available
MOISTURE:	Dry
ORGANIC MATTER:	Information not available
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Information not available
PLANTING TIME:	Information not available

MANAGEMENT

MAINTENANCE:	Information not available
INSECTS:	3 on genus
DISEASES:	None for this species, be certain of rust relationships before planting in agricultural area

PLANT LIST

SCIENTIFIC NAME: Berberis repens COMMON NAME: Creeping Barberry

TYPE:	Evergreen Ground Cover
ULTIMATE HEIGHT:	1' (.3m)
ULTIMATE SPREAD:	4-6' (10-15cm)
FORM:	Prostrate, creeping
TEXTURE:	Medium, to medium coarse
TWIGS:	Information not available
BARK:	Reddish-brown
LEAF DESCRIPTION:	1-3 1/2" pinnately compound, 3-7 leaflets, wavy leaf margins with bristle tips
LEAF COLOR:	Glossy green, evergreen summer, red autumn
FLOWER COLOR:	Yellow, racemes
FLOWER TIME:	Spring
FRUIT:	1/4" berry, black or bluish with a glaucous bloom
ROOT TYPE:	Creeping and stoloniferous
LIFE SPAN:	Continuous
POISONOUS:	Not poisonous

USE

BEST USE:	Ground cover, good on steep slopes
PALATABILITY:	Birds, deer

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	5,500-10,000', canyon bottoms, hillsides
RANGE SITES:	Information not available
EXPOSURE:	Sun, shade, partial shade
DROUGHT TOLERANCE:	Good to moderate
WIND FIRM:	Yes
ASPECT:	All
SOIL:	Loam

TEXTURE:	Coarse to medium
pH:	5.5 - 7.0
DEPTH:	Shallow to moderate
MOISTURE:	Dry to moist
ORGANIC MATTER:	No
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good on young plants, difficult on older plants
PLANTING TIME:	Information not available

MANAGEMENT

MAINTENANCE:	Clean
INSECTS:	None
DISEASES:	4 on species

PLANT LIST

SCIENTIFIC NAME: Betula occidentalis COMMON NAME: River Birch

TYPE:	Deciduous trees
ULTIMATE HEIGHT:	30' (9m)
ULTIMATE SPREAD:	Tree 10-15' (3-4.5m)
FORM:	Shrub or tree, ascending branches, clumplike, spreading, open crown
TEXTURE:	Medium
TWIGS:	Slender and drooping, green to reddish brown bark is roughened by small lenticles
BARK:	Smooth, brownish red, thin, with horizontal lenticles
LEAF DESCRIPTION:	1-2" broad, ovate, sharply pointed, sharply lobed, prominent veins
LEAF COLOR:	Summer green to yellow or reddish - Autumn, brown to orange
FLOWER COLOR:	Green
FLOWER TIME:	Spring, inconspicuous
FRUIT:	Brown cone-like catkins with rutlet; late summer, fall
ROOT TYPE:	Fibrous, spreading, shallow
LIFE SPAN:	Short, growth rate rapid
POISONOUS:	Not poisonous

USE

BEST USE:	Specimen, shrub mass, stream bank stabilization, erosion control, good flood control particularly on the headwaters of mountain streams
PALATABILITY:	Sheep, goats, birds, deer, beaver

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	5,000-8,000', bottom lands, rivers, streams
RANGE SITES:	Found throughout all of Utah in its suitable habitats
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	Stream side
SOIL:	

TEXTURE:	Medium; loam
pH:	6.5 - 7.0
DEPTH:	Shallow
MOISTURE	Moist to wet
ORGANIC MATTER:	No
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good when tree is young and buds are green
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Weak branches, clean
INSECTS:	20 on genus
DISEASES:	Many on genus only, none for this spp.

PLANT LIST

SCIENTIFIC NAME: Ceanothus prostratus COMMON NAME: Squaw Carpet

TYPE:	Evergreen ground cover
ULTIMATE HEIGHT:	3-8' (1-2.5m)
ULTIMATE SPREAD:	10' (3m)
FORM:	Prostrate plant forms a mat
TEXTURE:	Medium
TWIGS:	Red-brown
BARK:	Information not available
LEAF DESCRIPTION:	Toothed, leathery, holly-like, evergreen
LEAF COLOR:	Glossy, light-green
FLOWER COLOR:	Deep or light blue
FLOWER TIME:	Spring, April - June
FRUIT:	Capsule, red-green
ROOT TYPE:	Information not available
LIFE SPAN:	Information not available
POISONOUS:	Not poisonous

USE

BEST USE:	Excellent ground cover
PALATABILITY:	Deer, browse

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	3,000-6,500', information not available
RANGE SITES:	Information not available
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Information not available
WIND FIRM:	Information not available
ASPECT:	Northeast
SOIL:	

TEXTURE:	Rocky, loamy sand
pH:	Near acid soils
DEPTH:	Information not available
MOISTURE:	12 to 36+" precipitation
ORGANIC MATTER:	Information not available
DRAINAGE:	Well drained

ESTABLISHMENT

TRANSPLANTABILITY:	Information not available
PLANTING TIME:	Information not available

MANAGEMENT

MAINTENANCE:	Information not available
INSECTS:	None
DISEASES:	30 on genus

PLANT LIST

SCIENTIFIC NAME: Celtis reticulata COMMON NAME: Netleaf Hackberry

TYPE:	Deciduous tree
ULTIMATE HEIGHT:	30' (9m)
ULTIMATE SPREAD:	Information not available
FORM:	Large shrub to small or large tree, rounded even crown, many crooked branches
TEXTURE:	Medium
TWIGS:	Rounded with occasional small, corky ridges extending lengthwise
BARK:	Red-brown to gray, thick with prominent ridges and furrows
LEAF DESCRIPTION:	Leathery, veiny, unequal, elongated oval, 2" long, tapering point
LEAF COLOR:	Yellow-green
FLOWER COLOR:	Inconspicuous green
FLOWER TIME:	April
FRUIT:	Drupe, with thick walled nutlet, orange-red, edible
ROOT TYPE:	Information not available
LIFE SPAN:	Information not available
POISONOUS:	Not poisonous

USE

BEST USE:	Information not available
PALATABILITY:	Wildlife food, birds

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	2,500-6,000', stream courses, moist canyon and washes
RANGE SITES:	Widely scattered through Utah, along the Colorado River
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	Information not available
SOIL:	Limestone

TEXTURE:	Coarse to medium
pH:	Information not available
DEPTH:	Information not available
MOISTURE:	Moist
ORGANIC MATTER:	Information not available
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Information not available
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Clean
INSECTS:	6 on genus, subject to insect gall damage
DISEASES:	62 on genus, none specific

PLANT LIST

SCIENTIFIC NAME: Cercis occidentalis COMMON NAME: California Redbud

TYPE:	Deciduous tree
ULTIMATE HEIGHT:	6.5-20' (2-6m)
ULTIMATE SPREAD:	Information not available
FORM:	Small tree, trunks single or several, often forming clumps, crown rounded, branches spreading
TEXTURE:	Medium
TWIGS:	Reddish-brown when young, later dark gray, glabrous
BARK:	Gray, smooth, becoming slightly fissured in age
LEAF DESCRIPTION:	Circular with heart-shaped bases, simple 3" long
LEAF COLOR:	Dark green, blue-green summer, light yellow or red autumn
FLOWER COLOR:	Reddish, very numerous, showy, pea-like in structure
FLOWER TIME:	Spring
FRUIT:	Seed borne in pods 3" long, brown, legume
ROOT TYPE:	Information not available
LIFE SPAN:	Information not available
POISONOUS:	Not poisonous

USE

BEST USE:	Potential for ornamental plantings
PALATABILITY:	Poor browse

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	500-6,000', streams or dry rocky slopes of desert Ranges
RANGE SITES:	Extreme southern Utah: Washington, Kane, Garfield and San Juan counties
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	Information not available
SOIL:	Dark rocky clay, gravelly slopes, shaley silt loam

TEXTURE:	Medium to fine
pH:	Information not available
DEPTH:	Information not available
MOISTURE:	Dry slopes, moist
ORGANIC MATTER:	Information not available
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Information not available
PLANTING TIME:	Information not available

MANAGEMENT

MAINTENANCE:	Clean
INSECTS:	9 on genus
DISEASES:	4 main types on species

PLANT LIST

SCIENTIFIC NAME: Cercocarpus ledifolius COMMON NAME: Curly-leaf Mountain mahogany

TYPE:	Evergreen tree - shrub
ULTIMATE HEIGHT:	12' (4m)
ULTIMATE SPREAD:	Tree 15' (5m) Shrub 20' (6.6m)
FORM:	Shrub; small tree, sparse, open irregular, broad spreading crown
TEXTURE:	Fine
TWIGS:	Stiff, coarse, and crooked
BARK:	Reddish-brown or gray, scaly to plated between furrows
LEAF DESCRIPTION:	Small, thick, narrow-elliptical, leathery and smooth, aromatic, revotute margins, underside hairy white
LEAF COLOR:	Shiny dark green, white to tan underside
FLOWER COLOR:	Small, reddish, pink, yellowish
FLOWER TIME:	June - August
FRUIT:	2" (5 cm) seed elongated and pointed at ends ¼" long; 2" hairy corkscrew-twisted tail or plume on end
ROOT TYPE:	Shallow, wide spreading
LIFE SPAN:	Long-lived
POISONOUS:	Not poisonous

USE

BEST USE:	Ornament shrub for dry spots, ground cover
PALATABILITY:	Deer and elk browse

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	5,000-9,000', dry, gravelly, arid slopes
RANGE SITES:	Widespread and often abundant in Utah
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes, very
ASPECT:	South at higher elevations, all at lower elevations
SOIL:	

TEXTURE:	Coarse to rocky, sandy loam or clay
pH:	6.0 - 7.0
DEPTH:	Deep to shallow
MOISTURE:	Dry annual precipitation 12"+ (30.5 cm+)
ORGANIC MATTER:	No
DRAINAGE:	Well drained

ESTABLISHMENT

TRANSPLANTABILITY:	Difficult to transplant mature plants
PLANTING TIME:	December

MANAGEMENT

MAINTENANCE:	Pruning tolerant, clean
INSECTS:	None known
DISEASES:	9 on genus

PLANT LIST

SCIENTIFIC NAME: Cercocarpus montanus COMMON NAME: True Mountain Mahogany

TYPE:	Evergreen
ULTIMATE HEIGHT:	3-10' (1-3m)
ULTIMATE SPREAD:	6' (2m)
FORM:	Sparse, irregular but dense, symmetrical under cultivation
TEXTURE:	Fine
TWIGS:	Stout or slender, rigid: light red-brown at first, later ashen or reddish-gray
BARK:	Gray-brown, trunks fissured and scaly
LEAF DESCRIPTION:	Oval to obovate, serrate, round at apex
LEAF COLOR:	Green on top, whitish below
FLOWER COLOR:	Pink (small)
FLOWER TIME:	May - June
FRUIT:	White fuzzy 2" (5 cm) corkscrews - twisted tail or plume
ROOT TYPE:	Deep, spreading
LIFE SPAN:	Moderate
POISONOUS:	Not poisonous

USE

BEST USE:	Hedge, small shrub, barrier
PALATABILITY:	Deer winter-browse

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	4,000-9,500', grows in variety of habitats, stream beds and canyon bottoms to dry slopes and flats and rocky ridges
RANGE SITES:	All parts of Utah except in the ranges of the western desert
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Moderate to good, if well established
WIND FIRM:	Yes
ASPECT:	All
SOIL:	

TEXTURE:	Coarse to rocky
pH:	6.5 - 7.5
DEPTH:	Deep
MOISTURE:	Dry
ORGANIC MATTER:	No
DRAINAGE:	Well drained

ESTABLISHMENT

TRANSPLANTABILITY:	Difficult to transplant mature plants
PLANTING TIME:	Information not available

MANAGEMENT

MAINTENANCE:	Pruning tolerant, clean
INSECTS:	4 on genus
DISEASES:	9 on genus

PLANT LIST

SCIENTIFIC NAME: Chilopsis linearis COMMON NAME: Desertwillow

TYPE:	Deciduous tree
ULTIMATE HEIGHT:	6.5-25' (2-7.6m)
ULTIMATE SPREAD:	Information not available
FORM:	Small tree, often shrubby, several stems spreading to a broad combined crown
TEXTURE:	Fine
TWIGS:	Slender, occasionally sticky or woolly surfaces
BARK:	Very thin, dark brown, interlacing ridges and furrows
LEAF DESCRIPTION:	Willow-like, very narrow, 5" long, less than 1/2" wide, margins smooth
LEAF COLOR:	Pale green summer, yellow autumn
FLOWER COLOR:	Snowy white to pink, fragrant, 3 to 6" long
FLOWER TIME:	Spring through summer
FRUIT:	Seeds abundantly produced in long, round, slender 6" capsules
ROOT TYPE:	Information not available
LIFE SPAN:	Short-lived
POISONOUS:	Not poisonous

USE

BEST USE:	Ornamental, fuel and fence posts, erosion control
PALATABILITY:	Important components of wildlife habitat, unpalatable to livestock, poor browser

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	1,500-5,000', thicket-forming tree along dry washes in arid regions
RANGE SITES:	Southwest part of Utah, Washington County, along the Virgin and Santa Clara Rivers
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	Dry washes in arid regions
SOIL:	Dry sandy or gravelly soils

TEXTURE:	Coarse-medium
pH:	Information not available
DEPTH:	Information not available
MOISTURE:	Moist
ORGANIC MATTER:	Information not available
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Information not available
PLANTING TIME:	Dormant season

MANAGEMENT

MAINTENANCE:	Clean
INSECTS:	none listed
DISEASES:	4 on species

PLANT LIST

SCIENTIFIC NAME: Chrysothamnus nauseosus COMMON NAME: Rubber Rabbitbrush

TYPE:	Evergreen shrub
ULTIMATE HEIGHT:	2-3' (.6-1m)
ULTIMATE SPREAD:	2-3' (.6-1m)
FORM:	Dense, erect shrub with rounded head
TEXTURE:	Fine
TWIGS:	Clothed with persistent felt-like gray
BARK:	White, felty, fibrous
LEAF DESCRIPTION:	Long narrow pubescent 1" aromatic tomentose
LEAF COLOR:	Gray or white summer, gray or white autumn
FLOWER COLOR:	Yellow to golden
FLOWER TIME:	Late summer
FRUIT:	Plumose white achenes
ROOT TYPE:	Deep
LIFE SPAN:	Very short, 8-9 years
POISONOUS:	Not poisonous

USE

BEST USE:	Dry ornamental
PALATABILITY:	Poor browse, rubber ball former in cattle, many types within species complex are sought by all grazing animals

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	3,000-8,000', open slopes and flats, grows on disturbed areas
RANGE SITES:	Information not available
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good, seedlings sensitive to frost and drought
WIND FIRM:	Yes
ASPECT:	All
SOIL:	

TEXTURE:	Clay loam, sand loam
pH:	7.0 - 8.5
DEPTH:	Moderate
MOISTURE:	Dry, 6-10" precipitation
ORGANIC MATTER:	No
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Poor
PLANTING TIME:	November

MANAGEMENT

MAINTENANCE:	Carefree, clean
INSECTS:	None
DISEASES:	20 for species

PLANT LIST

SCIENTIFIC NAME: Chrysothamnus viscidiflorus COMMON NAME: Douglas Rabbitbrush

TYPE:	Evergreen shrub
ULTIMATE HEIGHT:	1-3' (.3-1m)
ULTIMATE SPREAD:	2-3' (.6-1m)
FORM:	Small, shrub rounded-head, erect branching
TEXTURE:	Fine
TWIGS:	Information not available
BARK:	White
LEAF DESCRIPTION:	Viscid leaves, elongated
LEAF COLOR:	Green summer, green autumn
FLOWER COLOR:	Yellow
FLOWER TIME:	July - September
FRUIT:	Information not available
ROOT TYPES:	Deep
LIFE SPAN:	Very short
POISONOUS:	Not poisonous

USE

BEST USE:	Ornamental shrub, accent
PALATABILITY:	Deer browse

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	5,000-10,000', information not available
RANGE SITES:	Information not available
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	All, south at higher elevations
SOIL:	Salt tolerance
	TEXTURE: Medium to fine
	pH: 7.0 - 8.5
	DEPTH: Deep
	MOISTURE: Dry
	ORGANIC MATTER: No
	DRAINAGE: Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Poor
PLANTING TIME:	Information not available

MANAGEMENT

MAINTENANCE:	Clean, carefree
INSECTS:	None known
DISEASES:	20 on species

PLANT LIST

SCIENTIFIC NAME: Clematis ligusticifolia COMMON NAME: Western Virgin's Bower

TYPE:	Vine
ULTIMATE HEIGHT:	12-18' (3.6-5.4m)
ULTIMATE SPREAD:	12-18' (3.6-5.4m)
FORM:	Spreading
TEXTURE:	Medium
TWIGS:	Thin stems
BARK:	Exfoliating bark
LEAF DESCRIPTION:	5-7 pinnate leaflets, ovate, toothed, clasping
LEAF COLOR:	Green, summer, light green, autumn
FLOWER COLOR:	2-3" White
FLOWER TIME:	May - August
FRUIT:	Achenes, white, pubescent
ROOT TYPE:	Shallow, vigorous
LIFE SPAN:	Short
POISONOUS:	Not poisonous

USE

BEST USE:	Vine situations
PALATABILITY:	Birds, deer

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	7,000' and below, river bottoms
RANGE SITES:	Information not available
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Poor
WIND FIRM:	No
ASPECT:	Stream banks
SOIL:	

TEXTURE:	Rocky loam
pH:	7.0
DEPTH:	Shallow to deep
MOISTURE:	Moist
ORGANIC MATTER:	Yes
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Yes
PLANTING TIME:	Information not available

MANAGEMENT

MAINTENANCE:	Clean, will overtop shrubs
INSECTS:	3 on species
DISEASES:	39 on genus

PLANT LIST

SCIENTIFIC NAME: Cornus stolonifera COMMON NAME: Redosier Dogwood

TYPE:	Deciduous Shrub
ULTIMATE HEIGHT:	7-8' (2.1-2.4m)
ULTIMATE SPREAD:	20' (6m)
FORM:	Shrub in clumps, spreading
TEXTURE:	Medium
TWIGS:	Strigose, bright red-purple
BARK:	Bright reddish purple
LEAF DESCRIPTION:	Leaves 3", pubescent and gray below, oval or elongated
LEAF COLOR:	Green summer, reddish autumn
FLOWER COLOR:	Small white in flat-top cyme 2-3" across
FLOWER TIME:	Spring, summer
FRUIT:	Small, berrylike drupe in clusters, white
ROOT TYPE:	Stoloniferous, spreading, layers
LIFE SPAN:	Moderate to short
POISONOUS:	Not poisonous

USE

BEST USE:	Specimen, mass shrub
PALATABILITY:	Birds

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	Below 9,000', canyon bottoms and stream courses
RANGE SITES:	Scattered throughout Utah's mountainous regions, streams and rivers
EXPOSURE:	Sun and shade
DROUGHT TOLERANCE:	Poor
WIND FIRM:	Yes
ASPECT:	Streamside
SOIL:	Wet loam

TEXTURE:	Medium to coarse
pH:	7.0 - 8.0
DEPTH:	Moderate
MOISTURE:	Moist to wet
ORGANIC MATTER:	No
DRAINAGE:	Good, water for short periods

ESTABLISHMENT

TRANSPLANTABILITY:	Readily transplants
PLANTING TIME:	November

MANAGEMENT

MAINTENANCE:	Clean, may need control on stolons
INSECTS:	11 on genus
DISEASES:	10 on species

PLANT LIST

SCIENTIFIC NAME: Cowania stansburiana COMMON NAME: Stansbury's Cliffrose

TYPE:	Evergreen shrubs
ULTIMATE HEIGHT:	3-10' (1-3m)
ULTIMATE SPREAD:	3-8' (1-2.4m)
FORM:	Shrub to small tree, narrow crown, irregular branching, freely branched
TEXTURE:	Fine to medium
TWIGS:	Slender, round, rigid, rather brittle, red and glabrous, crooked, short
BARK:	Gray-shreddy, reddish-gray-relatively thin
LEAF DESCRIPTION:	Small, deeply incised, close to branch, glandular, three to seven terminal lobes
LEAF COLOR:	Gray green summer, gray green autumn
FLOWER COLOR:	Yellow and white, 5/8 to 1" roselike
FLOWER TIME:	April - September
FRUIT:	Loose head of achenes with plumose
ROOT TYPE:	Deep, spreading
LIFE SPAN:	Moderate
POISONOUS:	Not poisonous

USE

BEST USE:	Ornamental shrub, hedge, very important browse plant
PALATABILITY:	Deer browse, cattle and sheep, birds

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	3,500-8,000', dry rocky foothills and mesas
RANGE SITES:	Widespread in most of Utah, not found north of Ogden or Uintah Basin
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	All, south at higher elevations
SOIL:	

TEXTURE:	Rocky to coarse or sandy
pH:	7.0 - 8.0
DEPTH:	Deep
MOISTURE:	Dry
ORGANIC MATTER:	No
DRAINAGE:	Well-drained, dry slopes and canyons

ESTABLISHMENT

TRANSPLANTABILITY:	Seedlings, transplant well, large plants poor
PLANTING TIME:	Fall, winter

MANAGEMENT

MAINTENANCE:	Carefree; tolerant of pruning
INSECTS:	None
DISEASES:	Phragmidium-rust

PLANT LIST

SCIENTIFIC NAME: Crataegus rivularis COMMON NAME: River Hawthorn

TYPE:	Deciduous trees
ULTIMATE HEIGHT:	20' (6m)
ULTIMATE SPREAD:	15-20' (4.5-6m)
FORM:	Small tree, ascending branches, occasionally shrub which forms a dense thicket
TEXTURE:	Medium
TWIGS:	Reddish-brown, glabrous and lustrous, coarse sharp spines
BARK:	Scaly, furrowed, gray, orangish, reddish-brown
LEAF DESCRIPTION:	Lanceolate to elliptic, margins finely serrate 2" in length
LEAF COLOR:	Blue-green summer, brown Autumn
FLOWER COLOR:	White, attractive, clusters
FLOWER TIME:	Spring, April - May
FRUIT:	Small, purple-black pome, fall-winter; crimson to black
ROOT TYPE:	Tap root
LIFE SPAN:	Moderate
POISONOUS:	Not poisonous

USE

BEST USE:	Specimen, streambank protection
PALATABILITY:	Birds eat fruit

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	5,000-6,000', streams and canyon bottoms
RANGE SITES:	Northern and central parts of state
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	Streamside
SOIL:	

TEXTURE:	Medium
pH:	7.0
DEPTH:	Deep
MOISTURE:	Moist
ORGANIC MATTER:	Yes
DRAINAGE:	Well-drained, can stand period of wet soil

ESTABLISHMENT

TRANSPLANTABILITY:	Poor due to tap root
PLANTING TIME:	Information not available

MANAGEMENT

MAINTENANCE:	Carefree, clean
INSECTS:	30 on genus
DISEASES:	7 on genus

PLANT LIST

SCIENTIFIC NAME: Ephedra nevadensis COMMON NAME: Nevada Mormon Tea

TYPE:	Evergreen shrubs
ULTIMATE HEIGHT:	1-5' (0.3-1.5m)
ULTIMATE SPREAD:	10' (3m)
FORM:	Shrub like, spreading, erect
TEXTURE:	Coarse
TWIGS:	Young stems pale green, glaucous, later, smooth, yellow or gray
BARK:	None
LEAF DESCRIPTION:	Inconspicuous, stems, pale, glaucous
LEAF COLOR:	Inconspicuous, stems green
FLOWER COLOR:	Yellow-green
FLOWER TIME:	Spring, March - May
FRUIT:	Nut-like
ROOT TYPE:	Information not available
LIFE SPAN:	Long
POISONOUS:	Not poisonous

USE

BEST USE:	Can be of value for erosion control
PALATABILITY:	Browse species, deer

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	Below 4,500', dry slopes and hills
RANGE SITES:	Information not available
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	Information not available
SOIL:	

TEXTURE:	Gravelly and stony soils
pH:	Information not available
DEPTH:	Information not available
MOISTURE:	6-10" precipitation
ORGANIC MATTER:	Information not available
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good when seedlings
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Clean, carefree
INSECTS:	None
DISEASES:	4 listed for species

PLANT LIST

SCIENTIFIC NAME: Ephedra viridis COMMON NAME: Green Mormon Tea

TYPE:	Evergreen shrub
ULTIMATE HEIGHT:	1-5' (0.3-1.5m)
ULTIMATE SPREAD:	10' (3m)
FORM:	Shrub like, erect, long broom-like yellow-green scabrous branchlets
TEXTURE:	Coarse
TWIGS:	Branches, bright green, yellow green
BARK:	None
LEAF DESCRIPTION:	Evergreen, scale-like branches
LEAF COLOR:	Inconspicuous
FLOWER COLOR:	Inconspicuous
FLOWER TIME:	Spring, April - June
FRUIT:	Nutlike
ROOT TYPE:	Information not available
LIFE SPAN:	Long
POISONOUS:	Not poisonous

USE

BEST USE:	Erosion control, forage
PALATABILITY:	Forage, deer browse

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	3,000-7,500', dry, rocky slopes, canyon walls
RANGE SITES:	Information not available
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Very drought resistant
WIND FIRM:	Yes
ASPECT:	Information not available
SOIL:	

TEXTURE:	Gravelly and stony soils, clay sand, rock
pH:	Alk-limestone cliffs, sal. on slightly saline-alkaline soils
DEPTH:	Information not available
MOISTURE:	6-10" precipitation
ORGANIC MATTER:	Information not available
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good when seedlings
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Clean, carefree
INSECTS:	None reported
DISEASES:	4 listed

PLANT LIST

SCIENTIFIC NAME: Eriogonum caespitosum COMMON NAME: Matted Buckwheat

TYPE:	Deciduous Ground Cover
ULTIMATE HEIGHT:	3-6" (7.5-15 cm)
ULTIMATE SPREAD:	2' (.6m)
FORM:	Low, compact matted perennial from much-branched woody caudex
TEXTURE:	Fine
TWIGS:	Information not available
BARK:	None, stems densely white-tomentose
LEAF DESCRIPTION:	1/3" ovate, densely tomentose, in whorls
LEAF COLOR:	White summer, white autumn
FLOWER COLOR:	Yellow to reddish
FLOWER TIME:	May - July
FRUIT:	Brown, achene in heads on stalk
ROOT TYPE:	Thick, woody tap root
LIFE SPAN:	Short
POISONOUS:	Not poisonous

USE

BEST USE:	Ground cover possibilities
PALATABILITY:	Deer, birds, rodents

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	5,000-8,600', gravelly slopes, dry sandy wash
RANGE SITES:	Information not available
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	All, south at higher elevations
SOIL:	Clay, sand

TEXTURE:	Fine to coarse
pH:	7.0+
DEPTH:	Moderate to shallow
MOISTURE:	8-12" annual precipitation
ORGANIC MATTER:	No
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Doubtful due to taproot
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Clean, carefree
INSECTS:	1 on genus
DISEASES:	14 on genus

PLANT LIST

SCIENTIFIC NAME: Eriogonum umbellatum COMMON NAME: Sulphur-flowered Buckwheat

TYPE:	Deciduous ground cover
ULTIMATE HEIGHT:	4-10" (10-25 cm)
ULTIMATE SPREAD:	2-3' (.6-1m)
FORM:	Prostrate, mat-forming, with upright flower stalks
TEXTURE:	Medium-fine
TWIG:	Information not available
BARK:	Shreddy brown
LEAF DESCRIPTION:	1" oblanceolate, tomentose below, in whorls
LEAF COLOR:	Green, summer, reddish-brown autumn
FLOWER COLOR:	Bright yellow on upright 8-12" stems
FLOWER TIME:	June - August
FRUIT:	Brown, winged, achene; attractive; late summer
ROOT TYPE:	Fibrous, layers, and spreads with branches, deep woody caudices
LIFE SPAN:	Short
POISONOUS:	Not poisonous

USE

BEST USE:	Ground cover; possible erosion control use
PALATABILITY:	Deer, birds

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	5,000-10,500', dry slopes
RANGE SITES:	Information not available
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	All, south at higher elevations
SOIL:	

TEXTURE:	Fine to coarse
pH:	7.0
DEPTH:	Moderate
MOISTURE:	Dry, annual precipitation 6-10"
ORGANIC MATTER:	No
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Poor
PLANTING TIME:	Information not available

MANAGEMENT

MAINTENANCE:	Clean, spread is not too vigorous
INSECTS:	1 on genus
DISEASES:	14 on genus

PLANT LIST

SCIENTIFIC NAME: Fraxinus anomala COMMON NAME: Singleleaf Ash

TYPE:	Deciduous tree
ULTIMATE HEIGHT:	6-23' (1.8-6.9m)
ULTIMATE SPREAD:	Information not available
FORM:	Pushy tree, shrub, crown round-topped, branches numerous, contorted spreading
TEXTURE:	Fine-medium
TWIGS:	4-angled, dark green to reddish-brown, pubescent at first later going gray and glabrous
BARK:	Thin, dark brown, narrow ridges covered with small thin scales
LEAF DESCRIPTION:	Thin, leathery, usually simple, occasionally compound, 3-5 leaflets, 1-2" margin entire round in shape
LEAF COLOR:	Green
FLOWER COLOR:	Greenish, appears in small clusters
FLOWER TIME:	April - May
FRUIT:	Clusters of smaras, 1" long, thin, flattened
ROOT TYPE:	Information not available
LIFE SPAN:	Information not available
POISONOUS:	Not poisonous

USE

BEST USE:	Occasionally cultivated as an ornamental
PALATABILITY:	Minor browse value, poor to good for cattle and sheep

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	2,500-6,000', dry canyons and gulches, major rivers and streams
RANGE SITES:	Widespread in southern and south-eastern portion of Utah
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	All, north slope of rocky clay
SOIL:	Thin, rocky soil
TEXTURE:	
pH:	Grows in limestone areas
DEPTH:	Information not available
MOISTURE:	Moist
ORGANIC MATTER:	Information not available
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good
PLANTING TIME:	Information not available

MANAGEMENT

MAINTENANCE:	Clean
INSECTS:	30 on genus, none specific
DISEASES:	70 on general group

PLANT LIST

SCIENTIFIC NAME: Fraxinus velutina COMMON NAME: Velvet Ash

TYPE:	Deciduous tree
ULTIMATE HEIGHT:	30-40' (9-12m)
ULTIMATE SPREAD:	Information not available
FORM:	Small to medium tree, relatively straight with a high rounded crown, spreading branches
TEXTURE:	Medium
TWIGS:	Glabrous, brownish in color
BARK:	Thin, grayish, divided into narrow ridges and furrows
LEAF DESCRIPTION:	Glabrous, thick, leathery, pinnately compound, 6" long, 5-9 elliptical leaflets, 2" long, finely toothed margin
LEAF COLOR:	Green
FLOWER COLOR:	Inconspicuous, greenish, male and female flowers on separate trees
FLOWER TIME:	March - May
FRUIT:	Clusters of pendant spatulate samaras, winged, 1" long
ROOT TYPE:	Information not available
LIFE SPAN:	Information not available
POISONOUS:	Not poisonous

USE

BEST USE:	Used for shade and landscaping purposes
PALATABILITY:	Minor browse value

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	2,500-7,000', wet site, canyon and along streams, areas of permanent water supply
RANGE SITES:	Stream courses and valley bottoms, mostly in Washington County
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	Information not available
SOIL:	Rocky wash, dry sandy flat near a wash
TEXTURE:	Information not available
pH:	Most alkali and drought resistant of ashes
DEPTH:	Deep
MOISTURE:	Moist
ORGANIC MATTER:	Information not available
DRAINAGE:	Information not available

ESTABLISHMENT

TRANSPLANTABILITY:	Information not available
PLANTING TIME:	Information not available

MANAGEMENT

MAINTENANCE:	Requires little care, clean
INSECTS:	5 which may be damaging
DISEASES:	6 on species

PLANT LIST

SCIENTIFIC NAME: Juniperus communis COMMON NAME: Mt. Common Juniper

TYPE:	Evergreen shrub
ULTIMATE HEIGHT:	3' (1m)
ULTIMATE SPREAD:	8-10' (2.4-3m)
FORM:	Lateral ascending branches, in dense patches, prostrate shrub
TEXTURE:	Fine
TWIGS:	Inconspicuous, covered with overlapping leaves
BARK:	Brown-gray
LEAF DESCRIPTION:	Small, awl-shaped leaves, sharp-pointed, linear-lanceolate needles
LEAF COLOR:	Green to whitish green summer, evergreen autumn
FLOWER COLOR:	Inconspicuous
FLOWER TIME:	Fruit evident in fall
FRUIT:	Obulate cone; glaucous blue berry
ROOT TYPE:	Fibrous spreading
LIFE SPAN:	Long-lived
POISONOUS:	Not poisonous

USE

BEST USE:	Low evergreen shrub for shade; can be used for erosion control
PALATABILITY:	Birds, deer, browes

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	5,000-7,000', information not available
RANGE SITES:	Information not available
EXPOSURE:	Sun or shade
DROUGHT TOLERANCE:	Good, if well-established
WIND FIRM:	Yes
ASPECT:	Northeast
SOIL:	

TEXTURE:	Fine to coarse
pH:	7.0
DEPTH:	Deep
MOISTURE:	Dry to moist
ORGANIC MATTER:	Yes, if possible
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Poor
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Can winterburn if exposed - clean
INSECTS:	10 on genus
DISEASES:	10 on genus

PLANT LIST

SCIENTIFIC NAME: Juniperus osteosperma COMMON NAME: Utah Juniper

TYPE:	Evergreen tree
ULTIMATE HEIGHT:	8-15' (2.6-5 m)
ULTIMATE SPREAD:	15-18' (5-6m)
FORM:	Tree, may be multi-branched, dense-rounded, slightly higher than broad
TEXTURE:	Medium
TWIGS:	Rather stout, covered with overlapping leaves
BARK:	Thin, ash-gray to reddish, fibrous shreds into long strips along stems
LEAF DESCRIPTION:	Small, green, scale-like leaves, glandular dotted, smooth margins
LEAF COLOR:	Green, yellowish green
FLOWER COLOR:	No flower
FLOWER TIME:	Spring
FRUIT:	Ovalate cone, glaucous-blue, berrylike, red-brown when mature
ROOT TYPE:	Fibrous, wide spreading
LIFE SPAN:	Long-moderate
POISONOUS:	Not poisonous

USE

BEST USE:	Screen, windbreak, evergreen, bonsai, fence posts
PALATABILITY:	Rodents, birds

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	4,000-7,500', common on dry rocky, gravelly, or sandy soils
RANGE SITES:	Common throughout Utah, except northwestern corner of the State
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	All, south at higher elevations
SOIL:	

TEXTURE:	Fine to coarse and rocky
pH:	7.0 - 8.0
DEPTH:	Deep
MOISTURE:	Dry - 12 - 20 inch precipitation
ORGANIC MATTER:	No
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good, when young
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Prune dead branches, clean
INSECTS:	10 on genus
DISEASES:	10 on genus

PLANT LIST

SCIENTIFIC NAME: Juniperus scopulorum COMMON NAME: Rocky Mountain Juniper

TYPE:	Evergreen Tree
ULTIMATE HEIGHT:	20-50' (6.6-15m)
ULTIMATE SPREAD:	25' (7.5m)
FORM:	Irregular crown, symmetrical, pointed, pyramidal, single-stems to multi-branching
TEXTURE:	Fine
TWIGS:	Drooping, inconspicuous, twigs are covered with leaves for several years
BARK:	Red-brown to gray-brown, twisted scaly, shreds readily
LEAF DESCRIPTION:	Small leaves, scale-like, grandular dotted, smooth margins
LEAF COLOR:	Silver-green, dark green or glaucus
FLOWER COLOR:	No flower, blue female cone
FLOWER TIME:	Spring
FRUIT:	Ovulate cone, small, glaucous blue berries ¼"
ROOT TYPE:	Fibrous, spreading: Deep, compact
LIFE SPAN:	Long - slow grower
POISONOUS:	Not poisonous

USE

BEST USE:	Screen, windbreak, bonsai, fence posts
PALATABILITY:	Birds, rodents

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	5,000-9,000', common on mountain slopes, rocks, crags, dry exposed ridges or moist cool hillsides
RANGE SITES:	Utah, restricted to the eastern and central portion, abundant in canyon bottom
EXPOSURE:	Sun, shade tolerant in youth
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	All, south at higher elevations
SOIL:	Calcareous soils

TEXTURE:	Fine to coarse, loam,
pH:	7.0 - 8.0
DEPTH:	Shallow to moderate
MOISTURE:	Annual precipitation 8-14"+, grows in wet and saline bottoms
ORGANIC MATTER:	No
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good when young
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Pruning tolerant, clean
INSECTS:	1 on species
DISEASES:	10 on species

PLANT LIST

SCIENTIFIC NAME: Larrea divaricata COMMON NAME: Spreading Creasotebush

TYPE:	Evergreen shrub
ULTIMATE HEIGHT:	4-8' (1.2-2.4m)
ULTIMATE SPREAD:	Information not available
FORM:	Irregular, brittle, many upright branches, spreading
TEXTURE:	Fine
TWIGS:	Information not available
BARK:	Brittle, grayish with dark, glandular bands at nodes
LEAF DESCRIPTION:	Dense, resinous, leathery
LEAF COLOR:	Yellow-green to dark green, yields a distinctive creosote odor
FLOWER COLOR:	Yellow, showy
FLOWER TIME:	Nearly year-round
FRUIT:	Capsule, round, densely white hairy, 5-celled
ROOT TYPE:	Information not available
LIFE SPAN:	Information not available
POISONOUS:	Not poisonous

USE

BEST USE:	Good for divider strips, wind or privacy screen
PALATABILITY:	Information not available

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	up to 5,000', dry plains and mesas
RANGE SITES:	Southwestern part of Utah
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	South slopes
SOIL:	

TEXTURE:	Information not available
pH:	Nonalkaline, nonsaline to 4'
DEPTH:	Information not available
MOISTURE:	3-5" precipitation
ORGANIC MATTER:	Information not available
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Clean
INSECTS:	None
DISEASES:	2 on species, mistletoe

PLANT LIST

SCIENTIFIC NAME: Picea engelmannii COMMON NAME: Engelmann Spruce

TYPE:	Evergreen tree
ULTIMATE HEIGHT:	100' (30m)
ULTIMATE SPREAD:	30-35' (9-10.6m)
FORM:	Large tree, narrow pyramidal crown, spreading, branches are in whorls
TEXTURE:	Medium
TWIGS:	Stout, shiny, orange-brown in color
BARK:	Large, loose brownish gray scales, bark thin
LEAF DESCRIPTION:	Small hairs on twig, squarish needle 1" long
LEAF COLOR:	Green; dark-bluegreen
FLOWER COLOR:	No flower, female cones chestnut brown
FLOWER TIME:	Spring - early summer
FRUIT:	Ovulate cone, 3-4" scarlet in spring, brown, summer, fall, winter
ROOT TYPE:	Vigorous shallow, spreading, deep on deep soils
LIFE SPAN:	Long - 400 years
POISONOUS:	Not poisonous

USE

BEST USE:	Lumber, screen, specimen, windbreak, erosion control for flood control
PALATABILITY:	Birds, deer

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	7000' to timberline
RANGE SITES:	Utah distribution spotty, Uinta, Deep Creek, La Sal and Abajos Mountain
EXPOSURE:	Shade tolerant when young, sun when older
DROUGHT TOLERANCE:	Poor
WIND FIRM:	Not if pure stands are thinned
ASPECT:	North, flats
SOIL:	

TEXTURE:	Medium
pH:	6.0 - 7.0
DEPTH:	Moderate to deep
MOISTURE:	Moist 25"+
ORGANIC MATTER:	Yes
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good when young older trees subject to desiccation
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Carefree, heavy needle fall
INSECTS:	13 on species, Engelmann spruce beetle, Spruce bud worm
DISEASES:	74 on genus, Brown butt rots, trunk rots

PLANT LIST

SCIENTIFIC NAME: Picea pungens COMMON NAME: Blue Spruce

TYPE:	Evergreen tree
ULTIMATE HEIGHT:	90' (27m)
ULTIMATE SPREAD:	25-30' (7.5-9m)
FORM:	Large tree, pyramidal crown, loses lower branches, branches are whorled
TEXTURE:	Fine to medium
TWIGS:	Stout, shiny, orange-brown, no pubescence
BARK:	Thick, gray, furrowed, slightly scaly on old trunk
LEAF DESCRIPTION:	1¼" needles, squarish, very stiff and very sharp
LEAF COLOR:	Glaucous bluegreen to silver
FLOWER COLOR:	Staminate: yellow, small
FLOWER TIME:	Early summer
FRUIT:	Ovulate, 3¼" (8 cm) paper-thin cone scales, pendulous, male "cones," yellow-red and small
ROOT TYPE:	Wide-spreading, moderately deep
LIFE SPAN:	Long to very long, 500 years or more
POISONOUS:	Not poisonous

USE

BEST USE:	Screen, specimen for large area, windbreak, ornamental planting
PALATABILITY:	Birds, deer

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	6,500-8,000', prefers moist sites, grows along streams or cooler hillsides
RANGE SITES:	Distribution spotty, occurs in the Uinta, Deep Creek, Central Wasatch Mountain
EXPOSURE:	Takes shade when young, sun when older
DROUGHT TOLERANCE:	Poor
WIND FIRM:	Not if stands are thinned
ASPECT:	North, streamside
SOIL:	

TEXTURE:	Medium
pH:	7.0
DEPTH:	Moderate
MOISTURE:	Moist - sometimes swampy
ORGANIC MATTER:	Yes
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	When young, older trees subject to desiccation
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Carefree, heavy needle fall
INSECTS:	13 on genus, spruce budworm
DISEASES:	74 on genus

PLANT LIST

SCIENTIFIC NAME: Pinus edulis COMMON NAME: Pinyon Pine

TYPE:	Evergreen trees
ULTIMATE HEIGHT:	15-35' (5-10.6m)
ULTIMATE SPREAD:	15' (5m)
FORM:	Round bushy, small tree, crown is small, rounded and bushy
TEXTURE:	Medium
TWIGS:	Slender, gray, smooth except for leaf scars, leaves persist for 9 years
BARK:	Gray-reddish, narrow, scales, 3/4" thick
LEAF DESCRIPTION:	1" needles in 2's or 3's, sharp-pointed, needle-like in "bundes" of twos
LEAF COLOR:	Yellow-green
FLOWER COLOR:	Yellow clusters
FLOWER TIME:	Early summer
FRUIT:	Ovulate cone: roundish, brown, with large seeds
ROOT TYPE:	Extensive, moderate to shallow
LIFE SPAN:	Long - slow growing, maturity in 250-300 years
POISONOUS:	Not poisonous

USE

BEST USE:	Screen, windbreak, bonsai, Christmas trees, rosin
PALATABILITY:	Birds and rodents

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	5,000-7,000', dry rocky foothills and mesas
RANGE SITES:	Extensive coverage in Utah's Colorado River Drainage
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good, withstand extremes in temperature and climate
WIND FIRM:	Yes
ASPECT:	All
SOIL:	

TEXTURE:	Coarse to rocky
pH:	7.0 - 7.5
DEPTH:	Deep to shallow
MOISTURE:	Dry-annual precipitation 12-20"
ORGANIC MATTER:	No
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Only when young in medium texture to gravelly soil
PLANTING TIME:	Seedlings in spring, seeds in fall

MANAGEMENT

MAINTENANCE:	Carefree; clean
INSECTS:	2 on species, damage done by insects and caterpillars to the cones
DISEASES:	9 on species

PLANT LIST

SCIENTIFIC NAME: Pinus flexilis COMMON NAME: Limber Pine

TYPE:	Evergreen trees
ULTIMATE HEIGHT:	30-45' (9-13.6m)
ULTIMATE SPREAD:	25-30' (7.5-10m)
FORM:	Medium-sized tree with rounded top, informal plume-like or dropping branches.
TEXTURE:	Medium to coarse
TWIGS:	Characteristically thick, often 1/2" in diameter, twigs are flexible, can be tied in knot, needles persist for 5-6 years
BARK:	Young bark gray; platy, brown with age, 2" thick
LEAF DESCRIPTION:	1-3", 5 bundled needles, stout, rigid and curved
LEAF COLOR:	Green, whitish-green; bluish-green
FLOWER COLOR:	Staminate, small reddish, inconspicuous
FLOWER TIME:	Early spring, inconspicuous
FRUIT:	Ovulate: green cone ripening to a 6" brown cone
ROOT TYPE:	Tap root, with several large laterals
LIFE SPAN:	Long, slow growth rate, maturity in 200 to 300 years
POISONOUS:	Not poisonous

USE

BEST USE:	Screen, windbreak, bonsai
PALATABILITY:	Birds, rodents

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	4,000-11,000', found in more open and dry environments
RANGE SITES:	Mountainous regions of Utah
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Moderate to good
WIND FIRM:	Yes
ASPECT:	All, exposed slopes, ridges
SOIL:	Widely adapted to different soils - poorly developed soil of rock crevices to heavy moist clays

TEXTURE:	Coarse
pH:	6.5 - 7.0
DEPTH:	Shallow to moderate
MOISTURE:	Dry, annual precipitation 20"+, dry ridges and slopes
ORGANIC MATTER:	No
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good on young stock
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Carefree, clean
INSECTS:	2 on species, bark beetles
DISEASES:	15 on species, dwarf mistletoe, root rot

PLANT LIST

SCIENTIFIC NAME: Pinus monophylla COMMON NAME: Singleleaf Pinyon

TYPE:	Evergreen trees
ULTIMATE HEIGHT:	20' (6.6m)
ULTIMATE SPREAD:	20' (6.6m)
FORM:	Small bushy tree with large laterals, may be multi-stemmed; symmetrical, irregular crown when young
TEXTURE:	Medium in youth to coarse with age
TWIGS:	Short, stout, and brittle, dull gray and smooth
BARK:	Dark-brown, scaly ridges, narrow flat ridges
LEAF DESCRIPTION:	1-2" single needle per fascicle, without sheath, coarse, rigid
LEAF COLOR:	Gray-green (pale)
FLOWER COLOR:	Staminate: small, orange in clusters - inconspicuous
FLOWER TIME:	Spring, summer, inconspicuous
FRUIT:	Ovulate: Green cones ripening to 1½-3" cone, tawny, yellow to light brown
ROOT TYPE:	Deep fibrous, spreading
LIFE SPAN:	Long lived - slow growing, maturity in 100-250 years
POISONOUS:	Not poisonous

USE

BEST USE:	Screen, windbreak, bonsai, Christmas trees
PALATABILITY:	Birds, rodents, deer, livestock, man

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	4,500-6,500' dry rocky slope, ridges, and mesas
RANGE SITES:	"Great Basin" tree
EXPOSURE:	Sun, intolerant of shade as an adult, seedlings thrive in partial shade
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	All, south at higher elevations
SOIL:	Not salt tolerant

TEXTURE:	Coarse to medium
pH:	6.0 - 7.0
DEPTH:	Deep to shallow
MOISTURE:	Dry; annual precipitation 8-14"+, drought resistant
ORGANIC MATTER:	No
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good on young stock
PLANTING TIME:	Seedlings in spring, seeds in fall

MANAGEMENT

MAINTENANCE:	Carefree, clean
INSECTS:	Many on species
DISEASES:	5 on species

PLANT LIST

SCIENTIFIC NAME: Pinus ponderosa COMMON NAME: Ponderosa Pine

TYPE:	Evergreen tree
ULTIMATE HEIGHT:	150' (45m)
ULTIMATE SPREAD:	20-30' (6.6-9m)
FORM:	Large tree, broad and round-topped, symmetrical in youth, conical, picturesque
TEXTURE:	Medium
TWIG:	Coarse and stout orange-yellow, leaves grow for approximately 5 years
BARK:	Thick brown-cinnamon scales, platy, black to brown, furrowed plates scaling off, yellow-orange beneath
LEAF DESCRIPTION:	4-11" needles in fascicles of 2's or 3's, stout
LEAF COLOR:	Yellowish-green to green
FLOWER COLOR:	Staminate, yellowish small, inconspicuous
FLOWER TIME:	Summer, inconspicuous
FRUIT:	Ovulate, green cones ripening to 6" brown cones
ROOT TYPE:	Tap root
LIFE SPAN:	Long-lived, slow growth rate, maturity 300-400 years
POISONOUS:	High nitrate content in pine needles, when eaten in enough quantity may cause abortion

USE

BEST USE:	Screen, windbreak, interesting bark, wood products, ornamental
PALATABILITY:	Porcupine, birds, rodents

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	5,000-8,000', common in the eastern mountain and plateau of Utah
RANGE SITES:	Information not available
EXPOSURE:	Shade in youth, sun in age
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	South, west
SOIL:	Can tolerate 8,000 ppm - Sal. soil-acid

TEXTURE:	Medium to coarse
pH	6.5 - 7.0
DEPTH:	Deep
MOISTURE:	Annual precipitation 10-12"+
ORGANIC MATTER:	No
DRAINAGE:	Well drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good, only when young due to tap root
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Carefree, clean
INSECTS:	45+ cone insects, bark beetle
DISEASES:	55+ on species, dwarf mistletoe fungi

PLANT LIST

SCIENTIFIC NAME: Populus angustifolia COMMON NAME: Narrowleaf Cottonwood

TYPE:	Deciduous trees
ULTIMATE HEIGHT:	45-60' (13.6-18m)
ULTIMATE SPREAD:	30-40' (9-12m)
FORM:	Young: pyramidal, old: irregular shaped crown, mounding, ascending branches
TEXTURE:	Medium
TWIGS:	Round, slender and greenish in color
BARK:	Young: smooth, yellow-green; old: gray, vertical furrows
LEAF DESCRIPTION:	3" lanceolate, coarsely serrate, glabrous - "Willow-like"
LEAF COLOR:	Summer, yellow-green, dark green; Autumn, bright yellow
FLOWER COLOR:	Catkins, green, 3 inches long
FLOWER TIME:	Spring, varies with altitude
FRUIT:	Whitish hair tufts, "Cotton" seeds avoid light brown capsule
ROOT TYPE:	Fibrous spreading, shallow, large laterals
LIFE SPAN:	Medium - 100-150 years
POISONOUS:	Not poisonous

USE

BEST USE:	High altitude shade tree, street tree, erosion control, stream bank protection
PALATABILITY:	Beaver food, wildlife food, saplings are browsed by deer and cattle

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	4,000-8,000', common along river channels near mouths of canyons and moist flats
RANGE SITES:	Widespread in mountainous areas through central and northern part of state
EXPOSURE:	Sun, bottoms
DROUGHT TOLERANCE:	Poor
WIND FIRM:	No
ASPECT:	Streamsides
SOIL:	

TEXTURE:	Medium to coarse, loamy sands
pH:	7.0
DEPTH:	Deep
MOISTURE:	Moist along streams
ORGANIC MATTER:	No
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good, when young
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Dieback in older branches, clean
INSECTS:	12 on genus
DISEASES:	27 for general group

PLANT LIST

SCIENTIFIC NAME: Populus fremontii COMMON NAME: Fremont Cottonwood

TYPE:	Deciduous trees
ULTIMATE HEIGHT:	70' (21.2m)
ULTIMATE SPREAD:	70' (21.2m)
FORM:	Tall tree, broad open crown, large widespreading limbs
TEXTURE:	Medium
TWIGS:	Glabrous, round, stout, green or light yellow-brown
BARK:	Old, whitish gray, roughly cracked bark, new thin, smooth, light green
LEAF DESCRIPTION:	Cordate, coarse and irregularly serrate, triangular
LEAF COLOR:	Bright green lustrous, fall, yellow
FLOWER COLOR:	Catkin 6"
FLOWER TIME:	Spring, March - April
FRUIT:	Capsule, ovoid, light brown, "cotton" covered
ROOT TYPE:	Fibrous spreading
LIFE SPAN:	Information not available
POISONOUS:	Not poisonous

USE

BEST USE:	Good shade tree, wind breaks, ornamental; erosion control stream bank protection
PALATABILITY:	Subject to procupine damage, animals eat seeds, browsers eat younger saplings

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	Below 6,000', found exclusively along rivers, streams and washes
RANGE SITES:	Abundant in southern portion of Utah, extends into central and northeastern counties
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Poor
WIND FIRM:	No
ASPECT:	Streamsides
SOIL:	

TEXTURE:	Heavy clay loam - sandy loam to gravel, medium to coarse
pH:	6.5 to 7.5
DEPTH:	Deep
MOISTURE:	Moist, along streams
ORGANIC MATTER:	No
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good when young
PLANTING TIME:	March, spring

MANAGEMENT

MAINTENANCE:	Clean, dieback in older branches
INSECTS:	12 on genus
DISEASES:	14 listed on species - mistletoe

PLANT LIST

SCIENTIFIC NAME: Populus tremuloides COMMON NAME: Quaking Aspen

TYPE:	Deciduous Trees
ULTIMATE HEIGHT:	18-40' (5.4-12m)
ULTIMATE SPREAD:	25-30' (7.5-9m)
FORM:	Slender, globose head to pyramidal
TEXTURE:	Medium
TWIGS:	Slender, round, and usually brownish-green
BARK:	Young: green-white, cream, smooth; Old: Rough, furrowed black, breaks into blocks or plates
LEAF DESCRIPTION:	Broadly ovate, acute tip, broad base, leaves nearly rounded, finely toothed margins
LEAF COLOR:	Summer, green; Autumn, yellow to bronze
FLOWER COLOR:	Catkins; greenish white "caterpillar-like"
FLOWER TIME:	Spring
FRUIT:	White hair tufts
ROOT TYPE:	Large underground laterals, spreading; majority of roots are in top 1" of soil
LIFE SPAN:	Short
POISONOUS:	Not poisonous

USE

BEST USE:	High altitude, specimen, shade; background, soil protection
PALATABILITY:	Beaver, elk and deer, stock, sheep, goats and cattle can overgraze the sprouts

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	6,000-10,000', cool moist mountain slopes and canyon bottoms, topography is gently rolling
RANGE SITES:	Common throughout Utah in the mountains
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Poor
WIND FIRM:	Good if open grown
ASPECT:	All, north at lower elevations
SOIL:	Rocky loam, 20-60"+ deep, loams, to extremely stoney

TEXTURE:	Medium to coarse
pH:	6.5 - 7.0
DEPTH:	Deep loam soils, well developed, silty clay loam or clay loam
MOISTURE:	Dry to moist, annual precipitation 20-60"+
ORGANIC MATTER:	Information not available
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	When Young
PLANTING TIME:	When plant is not in leaf

MANAGEMENT

MAINTENANCE:	Clean, dead branches provide entry for diseases, suckers
INSECTS:	12 on genus
DISEASES:	25 on species

PLANT LIST

SCIENTIFIC NAME: Potentilla fruticosa COMMON NAME: Shrubby Cinquefoil

TYPE:	Deciduous shrub
ULTIMATE HEIGHT:	3.5' (1.2m)
ULTIMATE SPREAD:	2' (.6m)
FORM:	Round-topped, much branching, densely leafy
TEXTURE:	Fine
TWIGS:	Information not available
BARK:	Shreddy
LEAF DESCRIPTION:	1" hairy, palmately 3-7 parted
LEAF COLOR:	Pale green, gray green summer, yellowish autumn
FLOWER COLOR:	Yellow
FLOWER TIME:	Summer (continuous)
FRUIT:	Inconspicuous, silky achene
ROOT TYPE:	Fibrous, spreading
LIFE SPAN:	Short
POISONOUS:	Not poisonous

USE

BEST USE:	Ornamental shrub, color accent, erosion control
PALATABILITY:	Browse

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	6,500-12,000', streams and wet meadows
RANGE SITES:	Information not available
EXPOSURE:	Sun, semi-shade
DROUGHT TOLERANCE:	Poor
WIND FIRM:	Yes
ASPECT:	All
SOIL:	

TEXTURE:	Medium to fine
pH:	6.5 - 7.0
DEPTH:	Shallow
MOISTURE:	Moist
ORGANIC MATTER:	Yes, if possible
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Yes
PLANTING TIME:	April

MANAGEMENT

MAINTENANCE:	Clean, carefree
INSECTS:	1 on genus
DISEASES:	3 on species, including 1 rust

PLANT LIST

SCIENTIFIC NAME: Prosopis juliflora COMMON NAME: Mesquite

TYPE:	Deciduous tree
ULTIMATE HEIGHT:	30-40' (9-12m)
ULTIMATE SPREAD:	Information not available
FORM:	Small tree, shrubby or thicket-forming, crown many spreading crooked branches, usually several trunks
TEXTURE:	Fine
TWIGS:	Coarse, stiff, somewhat zigzag in shape, reddish, spines at nodes
BARK:	Long, narrow ridges and strips, dark brown
LEAF DESCRIPTION:	Bi-pinnately compound 6" long, 15 pairs of 1" long, smooth-margined leaflets
LEAF COLOR:	Yellow-green to dark green summer, yellow autumn
FLOWER COLOR:	Yellow, fragrant, dense clusters
FLOWER TIME:	Early summer
FRUIT:	1/4" brownish bean, borne in pods, resembling wax string beans. Pod tightly constricted around each seed
ROOT TYPE:	Very extensive, spreading lateral roots, deep tap root
LIFE SPAN:	
POISONOUS:	Not poisonous

USE

BEST USE:	Attractive for landscaping, screening, windbreak, erosion control
PALATABILITY:	Food for wildlife and livestock, excellent source of honey

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	Below 5,000', valley bottoms and intermittent stream channels
RANGE SITES:	Virgin River drainage into Washington County
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	Information not available
SOIL:	

TEXTURE:	Information not available
pH:	Alkaline soils to slightly saline
DEPTH:	Deep
MOISTURE:	Moist
ORGANIC MATTER:	Information not available
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Information not available
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Clean, range pest, aggressive, hard to overgraze
INSECTS:	20 on genus
DISEASES:	20 on genus, none specific to this species

PLANT LIST

SCIENTIFIC NAME: Prunus virginiana COMMON NAME: Western Chokecherry

TYPE:	Deciduous trees
ULTIMATE HEIGHT:	30' (9 m)
ULTIMATE SPREAD:	15-20' (4.5-6m)
FORM:	Shrub to small tree, growing one to several trunks in dense thickets; tree has small high crown
TEXTURE:	Medium
TWIGS:	
BARK:	Smooth, reddish brown, horizontal lenticels
LEAF DESCRIPTION:	1-3 obovate, abruptly acute, round base, finely serrate margins, sharp pointed tips
LEAF COLOR:	Summer: dark green; glossy, Autumn: red-brown
FLOWER COLOR:	Small white in 4" racemes, attractive
FLOWER TIME:	Spring, April to June
FRUIT:	Dark purple to black berry; late summer attractive
ROOT TYPE:	Long laterals, suckers
LIFE SPAN:	Short
POISONOUS:	Sometimes poisonous to domestic livestock and browser where shrub is only source of forage; poison has not occurred in areas of good balance shrubs and herbs, can transmit western x disease to stone-fruit orchards

USE

BEST USE:	Ornamental shrub; in masses, fine spring flowers accent, ground cover
PALATABILITY:	Birds, deer, elk

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	4,500-8,000', abundant along streams and moist canyon bottoms
RANGE SITES:	Widely distributed in the state
EXPOSURE:	Sun or shade
DROUGHT TOLERANCE:	Poor
WIND FIRM:	Yes
ASPECT:	North, streamsides
SOIL:	

TEXTURE:	Medium to coarse
pH:	7.0
DEPTH:	Moderate
MOISTURE:	Moist
ORGANIC MATTER:	No
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good for young individual plant
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Carefree, some suckering; clean, may have some fruit drop
INSECTS:	67 on genus
DISEASES:	33 on species

PLANT LIST

SCIENTIFIC NAME: Pseudotsuga menziesii COMMON NAME: Douglas Fir

TYPE:	Evergreen trees
ULTIMATE HEIGHT:	130' (39.3m)
ULTIMATE SPREAD:	25-30' (7.5-9m)
FORM:	Pyramidal, symmetrical, graceful drooping branches
TEXTURE:	Medium to fine
TWIGS:	Slender, orange-brown and covered with short silky hairs
BARK:	Young: smooth, gray, thin, old: gray-brown ridges
LEAF DESCRIPTION:	1" flat needles, constricted at twig
LEAF COLOR:	Blue-green summer, evergreen autumn
FLOWER COLOR:	Small orange, staminate
FLOWER TIME:	Spring; inconspicuous
FRUIT:	2½" reddish-brown cone with distinctive protruding three-pronged leafy-like bracts
ROOT TYPE:	Well-developed, lateral, spreading
LIFE SPAN:	Moderate to long
POISONOUS:	Not poisonous

USE

BEST USE:	Screen, windbreak, lumber production, ornamental, erosion control, Excellent for restoring eroded lands, watersheds, and strip-mined areas
PALATABILITY:	Squirrels, birds

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	5,000-8,000', most abundant in nearly pure stands
RANGE SITES:	Cool, moist north-facing slopes or canyon walls
EXPOSURE:	Shade when young, sun in age
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes, if not over thinned
ASPECT:	North, steep slopes
SOIL:	

TEXTURE:	Medium to coarse
pH:	6.0 - 7.0
DEPTH:	Deep
MOISTURE:	Moist slopes
ORGANIC MATTER:	Yes
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good when young
PLANTING TIME:	Information not available

MANAGEMENT

MAINTENANCE:	Clean, carefree
INSECTS:	5 on species
DISEASES:	61 on species

PLANT LIST

SCIENTIFIC NAME: Purshia tridentata COMMON NAME: Antelope Bitterbush

TYPE:	Evergreen shrub
ULTIMATE HEIGHT:	9' (2.7m)
ULTIMATE SPREAD:	3-4' (1-1.2m)
FORM:	Stemmy, irregular, small to large branched shrub
TEXTURE:	Fine
TWIGS:	Glandular, young twigs tomentose, short and stubby, spur-like
BARK:	Shreddy, twisted, brownish, gray
LEAF DESCRIPTION:	Aromatic, three-lobed, thickened, wedge-shaped, tomentose
LEAF COLOR:	Gray green above, white below summer, brown autumn
FLOWER COLOR:	Cream-yellow
FLOWER TIME:	April - August
FRUIT:	Achene
ROOT TYPE:	Fibrous, spreading
LIFE SPAN:	Moderate
POISONOUS:	Not poisonous

USE

BEST USE:	Ornamental shrub, hedge, but rarely used, useful for erosion
PALATABILITY:	Excellent deer browse, rodents, birds, cattle, and sheep

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	4,000-8,000', arid plains, foothills and mountain slopes
RANGE SITES:	Common in Utah except western desert range
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Exceptionally drought resistant
WIND FIRM:	Yes
ASPECT:	South, east, southeast
SOIL:	

TEXTURE:	Rocky, sandy
pH:	6.0 - 7.5
DEPTH:	Moderate to deep
MOISTURE:	Dry
ORGANIC MATTER:	No
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Seedlings transplant, nursery stock, mediocre to poor
PLANTING TIME:	April - May

MANAGEMENT

MAINTENANCE:	Carefree, clean
INSECTS:	None
DISEASES:	None

PLANT LIST

SCIENTIFIC NAME: Quercus chrysolepis var. palmeri COMMON NAME: Palmer Oak

TYPE:	Evergreen Tree
ULTIMATE HEIGHT:	6-25' (1.8-7.5m)
ULTIMATE SPREAD:	Information not available
FORM:	Stiff shrub, dense, broad crown with coarse, crooked branches
TEXTURE:	Medium
TWIGS:	Slender and brownish, smooth to flaky
BARK:	Fissured into long narrow ridges
LEAF DESCRIPTION:	Thick, oval to elongated, 1 1/2", spiney toothed margin, smooth on entire margin when older
LEAF COLOR:	Gray-green above, tomentose below
FLOWER COLOR:	Inconspicuous
FLOWER TIME:	April - May
FRUIT:	Acorn, biennial, 1" long, tapered point
ROOT TYPE:	Information not available
LIFE SPAN:	Long-lived
POISONOUS:	Acorns may poison stock

USE

BEST USE:	Useful for erosion control
PALATABILITY:	Provides wildlife cover and food

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	3,000-7,000', dry canyons and mountain sides
RANGE SITES:	Southwestern Utah
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	Information not available
SOIL:	Decomposed granite, sandy loam

TEXTURE:	Coarse to medium
pH:	Information not available
DEPTH:	Information not available
MOISTURE:	Dry
ORGANIC MATTER:	Information not available
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Poor
PLANTING TIME:	Fall

MANAGEMENT

MAINTENANCE:	Clean
INSECTS:	76 on genus
DISEASES:	Many for genus

PLANT LIST

SCIENTIFIC NAME: Quercus gambelii COMMON NAME: Gambel Oak

TYPE:	Deciduous trees
ULTIMATE HEIGHT:	9-15' (2.7-9.5m)
ULTIMATE SPREAD:	12-15' (3.6-4.5m)
FORM:	Shrub or small trees, irregular crown, sometimes dense thickets
TEXTURE:	Coarse
TWIGS:	Red-brown and pubescent at first, later orange-brown, glabrous, stout
BARK:	Rough, furrowed, gray-brown, thin to thick
LEAF DESCRIPTION:	Ovate, repand sinuses; 5" lobed, large and hairiness
LEAF COLOR:	Bright green, lighter under summer; golden brown; reddish brown autumn
FLOWER COLOR:	Light green, inconspicuous
FLOWER TIME:	May - June
FRUIT:	Annual acorn, 1/2" diameter, ripen in August or September
ROOT TYPE:	Deep
LIFE SPAN:	Long - very long
POISONOUS:	Toxic substance is tannin, more than 75 percent in diet may cause death

USE

BEST USE:	Small tree, background, watershed protection
PALATABILITY:	Rodents, deer browse

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	4,500 - 8,000', streamsides and canyons to rocky hillsides
RANGE SITES:	Widespread in most of Utah, northern limits about 45 miles north of Salt Lake City
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Moderate
WIND FIRM:	Yes
ASPECT:	All
SOIL:	Granitic parent materials, sandy, gravelly
TEXTURE:	Coarse
pH:	7.0 - 7.5
DEPTH:	Deep
MOISTURE:	Dry, annual precipitation 12-25"
ORGANIC MATTER:	Yes, if possible
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Poor to impossible because of tap root
PLANTING TIME:	Fall is best

MANAGEMENT

MAINTENANCE:	Dead branches; clean
INSECTS:	1 on genus
DISEASES:	14 on species

PLANT LIST

SCIENTIFIC NAME: Quercus turbinella COMMON NAME: Shrub Live Oak

TYPE:	Evergreen shrub
ULTIMATE HEIGHT:	5-9' (1.6-3m)
ULTIMATE SPREAD:	Information not available
FORM:	Much-branched shrub, or small tree, crown open, wide and spreading
TEXTURE:	Fine
TWIGS:	Rather rigid, densely gray-yellow
BARK:	Dark brown or gray, fissured and scaly
LEAF DESCRIPTION:	Holly-like, 1" thick, stiff and leathery, elliptic to ovate
LEAF COLOR:	Blue-green, covered with whitish bloom
FLOWER COLOR:	Inconspicuous
FLOWER TIME:	Spring
FRUIT:	Acorns, 0.7" yellow-brown
ROOT TYPE:	Information not available
LIFE SPAN:	Information not available
POISONOUS:	Acorns may poison stock

USE

BEST USE:	Information not available
PALATABILITY:	Deer browse

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	3,500 to 6,000', dry slopes, canyons and mesas
RANGE SITES:	Southwestern part of Utah, Washington County
EXPOSURE:	Sun
DROUGHT TOLERANCE	Good
WIND FIRM:	Yes
ASPECT:	Information not available
SOIL:	

TEXTURE:	Coarse to medium
pH:	Information not available
DEPTH:	Information not available
MOISTURE:	Very drought resistant, dry
ORGANIC MATTER:	Information not available
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Poor
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Clean
INSECTS:	76 on genus - none on spp.
DISEASES:	Many on genus, none specific

PLANT LIST

SCIENTIFIC NAME: Rhus glabra COMMON NAME: Smooth Sumac

TYPE:	Deciduous shrubs
ULTIMATE HEIGHT:	6-7' (1.8-2.1m)
ULTIMATE SPREAD:	5-9' (1.5-2.7m)
FORM:	Erect, few-branched, straggling shrub or small tree
TEXTURE:	Medium to coarse
TWIGS:	Stout, glabrous, greenish to reddish-brown
BARK:	Gray, rough at leaf scars, glabrous
LEAF DESCRIPTION:	Leaflets lanceolate, serrulate 2", glabrous, pinnately compound
LEAF COLOR:	Green above, whitish below summer, rose, scarlet, autumn
FLOWER COLOR:	Green small, in panicles
FLOWER TIME:	June - August
FRUIT:	Red, hairy, berry-like in head ripens in September and October
ROOT TYPE:	Shallow
LIFE SPAN:	Short
POISONOUS:	Not poisonous

USE

BEST USE:	Ornamental shrub, occasionally used for erosion control
PALATABILITY:	Birds and mammals

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	4,500-7,000', information not available
RANGE SITES:	Restricted in Utah, Wasatch mountains
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	South
SOIL:	

TEXTURE:	Coarse
pH:	6.5 - 7.0
DEPTH:	Shallow to moderate
MOISTURE:	Dry to moist
ORGANIC MATTER:	No
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Easily transplanted
PLANTING TIME:	Information not available

MANAGEMENT

MAINTENANCE:	Clean, carefree
INSECTS:	14 on genus
DISEASES:	14 on species

PLANT LIST

SCIENTIFIC NAME: Rhus trilobata COMMON NAME: Skunk Brush

TYPE:	Deciduous shrub
ULTIMATE HEIGHT:	1 1/2-6' (.4-1.8m)
ULTIMATE SPREAD:	10' (3.0m)
FORM:	Round top, multi-branched shrub, branches spreading, strongly scented
TEXTURE:	Medium to fine
TWIGS:	Slender, gray to reddish-brown, puberulent at first, later glabrous
BARK:	inconspicuous, heavily pubescent
LEAF DESCRIPTION:	Small 1-1 1/2" 3-lobed, odoriferous
LEAF COLOR:	Green, summer, yellow green, golden orange Autumn
FLOWER COLOR:	Inconspicuous, yellow
FLOWER TIME:	Inconspicuous, spiny, March - April
FRUIT:	Plumose, crimson drupe
ROOT TYPE:	Spreading fibrous
LIFE SPAN:	Moderate
POISONOUS:	Not poisonous

USE

BEST USE:	Ornamental shrub, mass background, erosion control
PALATABILITY:	Birds

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	3,500-9,000', dry rocky hillsides, occasionally streams
RANGE SITES:	Widespread throughout Utah, both mountainous regions and arid lowlands
EXPOSURE:	Shade or sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	South
SOIL:	

TEXTURE:	Medium to coarse
pH:	6.5 - 7.5
DEPTH:	Deep
MOISTURE:	Dry slopes, slightly moist
ORGANIC MATTER:	No
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Yes
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Clean, carefree
INSECTS:	14 on genus
DISEASES:	7 on species

PLANT LIST

SCIENTIFIC NAME: Ribes aureum COMMON NAME: Golden Currant

TYPE:	Deciduous shrub
ULTIMATE HEIGHT:	4' (1.2m)
ULTIMATE SPREAD:	4' (1.2m)
FORM:	Clump, round shrub, arching branches
TEXTURE:	Fine to medium
TWIGS:	Puberulous at first, later glabrous
BARK:	Grayish
LEAF DESCRIPTION:	Spineless, 3-5 lobed 1 1/2", obovate to uniform
LEAF COLOR:	Green, summer, light green autumn
FLOWER COLOR:	Yellow in axillary racemes 1" turn rose
FLOWER TIME:	Spring, April - May
FRUIT:	1/2" berry, yellow, red, black
ROOT TYPE:	Underground suckering
LIFE SPAN:	Continuous, regenerates by suckering
POISONOUS:	Not poisonous

USE

BEST USE:	Coarse screen, erosion control
PALATABILITY:	Birds, browse and wildlife value

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	4,000-10,000', moist canyons and along streams
RANGE SITES:	Common in most of the mountain regions of Utah
EXPOSURE:	Sun or shade
DROUGHT TOLERANCE:	Moderate
WIND FIRM:	Yes
ASPECT:	All
SOIL:	

TEXTURE:	Coarse to medium
pH:	6.5 - 7.0
DEPTH:	Shallow to deep
MOISTURE:	Moist or dry
ORGANIC MATTER:	If possible
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Yes
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Clean, carefree
INSECTS:	7 on species
DISEASES:	23 on species

PLANT LIST

SCIENTIFIC NAME: Robinia neomexicana COMMON NAME: New Mexico Locust

TYPE:	Deciduous shrub
ULTIMATE HEIGHT:	6-25' (1.8-7.5m)
ULTIMATE SPREAD:	Information not available
FORM:	Spiny shrub or small tree, forms thickets, sprouts freely from stumps and roots
TEXTURE:	Fine
TWIGS:	Slender, mostly round or slightly winged, reddish-brown to gray, spines 1/2" in pairs of leaf nodes
BARK:	Thin, furrowed, light brown, separating into small plates
LEAF DESCRIPTION:	Alternate, odd-pinnately compound 6 to 8",13 to 21 leaflets 1", elliptic-laceolate, margins entire
LEAF COLOR:	Gray-green
FLOWER COLOR:	Pale purple to white, drooping racemes, showy, pea-like
FLOWER TIME:	April - August
FRUIT:	Legume seed pods 3" long, flat, brownish and covered with bristly glandular hairs
ROOT TYPE:	Information not available
LIFE SPAN:	Short-lived
POISONOUS:	Not poisonous

USE

BEST USE:	Erosion control, ornamental
PALATABILITY:	Browsed by cattle, sheep, deer, porcupine

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	4,000-8,500', streams, washes or mountain slopes
RANGE SITES:	Extreme southern Utah, from Santa Clara to Kanab
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	Northwest slopes
SOIL:	

TEXTURE:	Information not available
pH:	Information not available
DEPTH:	Deep
MOISTURE:	Dry, some moisture
ORGANIC MATTER:	Information not available
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Information not available
PLANTING TIME:	March, April

MANAGEMENT

MAINTENANCE:	Clean
INSECTS:	None specific, 9 on genus
DISEASES:	7 on group

PLANT LIST

SCIENTIFIC NAME: Rosa woodsii COMMON NAME: Wood's Rose

TYPE:	Deciduous shrubs
ULTIMATE HEIGHT:	1 1/2-9' (.4-2.7m)
ULTIMATE SPREAD:	6-9' (1.8-27m)
FORM:	Arching shrub, in clump or thickets, stout, with straight slender prickles
TEXTURE:	Medium
TWIGS:	Information not available
BARK:	Dark reddish
LEAF DESCRIPTION:	Compound, ovate, acuminate, serrate, prickles only at base
LEAF COLOR:	Dark green, summer - yellow, autumn
FLOWER COLOR:	Delicate, pink to reddish
FLOWER TIME:	June
FRUIT:	Fleshy hip, red
ROOT TYPE:	Stoloniferous, shallow, spreading
LIFE SPAN:	Moderate, regenerating root stocks
POISONOUS:	Not poisonous

USE

BEST USE:	Barrier, ornamental shrub, erosion control, road cuts and gullies
PALATABILITY:	Birds, rodents

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	8,500-9,000', dry sands, along streams, moist places
RANGE SITES:	Information not available
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Moderate
WIND FIRM:	No
ASPECT:	All
SOIL:	

TEXTURE:	Medium to coarse, sandy loam or sand
pH:	6.0 - 7.0
DEPTH:	Shallow to deep
MOISTURE:	Moist to dry
ORGANIC MATTER:	If possible
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good
PLANTING TIME:	Information not available

MANAGEMENT

MAINTENANCE:	Clean, may become large clump
INSECTS:	15 on species
DISEASES:	37 on species

PLANT LIST

SCIENTIFIC NAME: Salix amygdaloides COMMON NAME: Peachleaf Willow

TYPE:	Deciduous tree
ULTIMATE HEIGHT:	30' (9m)
ULTIMATE SPREAD:	Information not available
FORM:	Tree, crown compact or open, rounded or irregular, branches upright or drooping
TEXTURE:	Medium
TWIGS:	Long, slender, often drooping at end, yellowish to red-brown
BARK:	Thick, reddish-brown to dark brown, deeply furrowed, ridges broad
LEAF DESCRIPTION:	Thin, firm, lanceolate to ovate-lanceolate 1/2"-1 1/2"
LEAF COLOR:	Yellowish-green top, whitish, glaucous bottom summer, yellow autumn
FLOWER COLOR:	Staminate catkins 1-3" yellow
FLOWER TIME:	Spring
FRUIT:	Distillate catkins, light yellow to orange-yellow
ROOT TYPE:	Spreading fibrous
LIFE SPAN:	Short
POISONOUS:	Not poisonous

USE

BEST USE:	Ornamental
PALATABILITY:	Moose, elk, deer, small birds, cattle, sheep, goats

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	3,500-8,500', stream bottom and water table sites
RANGE SITES:	Damp environments throughout state
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Poor
WIND FIRM:	Yes
ASPECT:	All streamsides
SOIL:	

TEXTURE:	Medium
pH:	6.5 - 7.5
DEPTH:	Moderate
MOISTURE:	Wet, damp
ORGANIC MATTER:	
DRAINAGE:	Wet

ESTABLISHMENT

TRANSPLANTABILITY:	Good
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Information not available
INSECTS:	Information not available
DISEASES:	Information not available

PLANT LIST

SCIENTIFIC NAME: Salix bebbiana COMMON NAME: Bebb Willow

TYPE:	Deciduous tree-shrub
ULTIMATE HEIGHT:	8-9' (2.4-2.7m)
ULTIMATE SPREAD:	4-5' (1.2-1.5m)
FORM:	Shrub much-branched, occasionally small tree, crown dense bushy, rounded
TEXTURE:	Medium
TWIGS:	Slender, branching at wide angles, yellowish to orange, brown or gray
BARK:	Gray, purple-brown, thin
LEAF DESCRIPTION:	Obovate, entire 1-3"
LEAF COLOR:	Dull green summer, yellow autumn
FLOWER COLOR:	Staminate catkins, 1/2" inconspicuous
FLOWER TIME:	Spring
FRUIT:	Pistillate catkins: 1-2" Whitish-yellow, capsule
ROOT TYPE:	Fibrous, spreading
LIFE SPAN:	Short
POISONOUS:	Not poisonous

USE

BEST USE:	Streamside erosion control, mass background
PALATABILITY:	Deer, elk, beaver, small mammals, birds, sheep, cattle

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	7,000-12,000', streams or dry mountain slopes
RANGE SITES:	Scattered through high mountains of Utah except the central portion of the state
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Poor
WIND FIRM:	Yes
ASPECT:	All, streamside
SOIL:	

TEXTURE:	Medium to coarse
pH:	7.0
DEPTH:	Moderate
MOISTURE:	Wet to dry
ORGANIC MATTER:	No
DRAINAGE:	Boggy or wet

ESTABLISHMENT

TRANSPLANTABILITY:	Good
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Clean, carefree
INSECTS:	91 on genus
DISEASES:	Many on genus

PLANT LIST

SCIENTIFIC NAME: Salix exigua COMMON NAME: Coyote Willow

TYPE:	Deciduous tree-shrub
UTLIMATE HEIGHT:	6-12' (1.8-3.6m)
ULTIMATE SPREAD:	3-5' (.9-1.5m)
FORM:	Shrub or small tree, rounded in youth, irregular in age; can form thickets, many-branched
TEXTURE:	Fine
TWIGS:	Reddish when young, hairy and greenish
BARK:	Gray when older
LEAF DESCRIPTION:	Canescent, linear 4"
LEAF COLOR:	Green-gray, silvery tomentose summer, yellow autumn
FLOWER COLOR:	Staminate catkins: 1" yellowish
FLOWER TIME:	Spring, March - May
FRUIT:	Capsule
ROOT TYPE:	Fibrous, spreading
LIFE SPAN:	Short
POISONOUS:	Not poisonous

USE

BEST USE:	Streamside erosion control, mass background
PALATABILITY:	Beaver, deer browse

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	Below 6,000', streams and moist areas
RANGE SITES:	Lower elevations along stream courses throughout entire state
EXPOSURE:	Sun, south
DROUGHT TOLERANCE:	Poor
WIND FIRM:	Yes
ASPECT:	All streamside
SOIL:	

TEXTURE:	Medium to coarse, rock and loam
pH:	7.0 - 8.0
DEPTH:	Moderate
MOISTURE:	Wet, very moist sites
ORGANIC MATTER:	No
DRAINAGE:	Wet or boggy

ESTABLISHMENT

TRANSPLANTABILITY:	Good
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Limb breakage; clean
INSECTS:	91 on genus
DISEASES:	Many on genus

PLANT LIST

SCIENTIFIC NAME: Salix geyeriana COMMON NAME: Geyer Willow

TYPE:	Deciduous Tree-shrub
ULTIMATE HEIGHT:	9' (2.7m)
ULTIMATE SPREAD:	10-15' (3-4.5m)
FORM:	Shrubby, multi-branched with ascending branches
TEXTURE:	Medium
TWIGS:	Information not available
BARK:	Brown-purple, with glaucous bloom
LEAF DESCRIPTION:	Linear-laceolate 1-2 1/2"
LEAF COLOR:	Green summer, yellow-green autumn
FLOWER COLOR:	Staminate catkins 1/2" yellowish to reddish
FLOWER TIME:	Spring
FRUIT:	Pistillate catkins: 1/2" globose, reddish
ROOT TYPE:	Deep, spreading, fibrous
LIFE SPAN:	Short
POISONOUS:	Not poisonous

USE

BEST USE:	Watersides, mass compositions, stream erosion control
PALATABILITY:	Deer, small birds, sheep and cattle

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	4,000-8,000', moist areas, streams, rivers
RANGE SITES:	Scattered through high mountain sites
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Poor
WIND FIRM:	Yes
ASPECT:	All
SOIL:	

TEXTURE:	Medium
pH:	5.0 - 6.5
DEPTH:	Moderate
MOISTURE:	Moist to wet
ORGANIC MATTER:	Yes
DRAINAGE:	Wet, boggy

ESTABLISHMENT

TRANSPLANTABILITY:	Good when young
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Clean
INSECTS:	91 on genus
DISEASES:	Many on genus

PLANT LIST

SCIENTIFIC NAME: Salix gooddingii COMMON NAME: Goodding Willow

TYPE:	Deciduous tree-shrub
ULTIMATE HEIGHT:	40-45' (12.1-13.6m)
ULTIMATE SPREAD:	Information not available
FORM:	Large shrub or tree, long and slender in crowded conditions, branches short, ascending
TEXTURE:	Medium
TWIGS:	Slender, easily detached, yellowish to orange or grayish, pubescent first, glabrous later.
BARK:	Thick, gray or blackish, deeply furrowed, narrow ridges
LEAF DESCRIPTION:	Lanceolate to elliptic, margins serrate
LEAF COLOR:	Dull green summer, yellow autumn
FLOWER COLOR:	Staminate catkins 1-2" yellow
FLOWER TIME:	Spring
FRUIT:	Pistillate catkins, reddish-brown
ROOT TYPE:	Deep, spreading, fibrous
LIFE SPAN:	Short
POISONOUS:	Not poisonous

USE

BEST USE:	Stream bank protection and erosion control
PALATABILITY:	Deer browse, birds

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	4,000-5,000', streamside of desert country
RANGE SITES:	Extreme southern part of the state, Washington County, Colorado and San Juan Rivers
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Somewhat drought tolerance
WIND FIRM:	Moderate
ASPECT:	All streamsides
SOIL:	

TEXTURE:	Medium
pH:	6.5-7.5
DEPTH:	Information not available
MOISTURE:	Wet to dry
ORGANIC MATTER:	Information not available
DRAINAGE:	Wet

ESTABLISHMENT

TRANSPLANTABILITY:	Good when young
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Information not available
INSECTS:	Information not available
DISEASES:	Information not available

PLANT LIST

SCIENTIFIC NAME: Salix lasiandra COMMON NAME: Pacific Willow

TYPE:	Deciduous tree-shrub
ULTIMATE HEIGHT:	15-45' (4.5-13.6m)
ULTIMATE SPREAD:	15' (4.5m)
FORM:	Small round tree or large shrub, crown open, branches straight, ascending
TEXTURE:	Medium
TWIGS:	Reddish, shining, glabrous, stout
BARK:	Rough brown
LEAF DESCRIPTION:	2-4" oblanceolate, acuminate, glandular serrulate
LEAF COLOR:	Dark green summer, yellow autumn, glaucous beneath
FLOWER COLOR:	Staminate: catkins, 2-3" terminal, white
FLOWER TIME:	Spring
FRUIT:	Pistillate: catkins, 4" yellowish to white, inconspicuous capsule
ROOT TYPE:	Fibrous, spreading
LIFE SPAN:	Short
POISONOUS:	Not poisonous

USE

BEST USE:	Small shade tree at high elevations, background, stream erosion control
PALATABILITY:	Deer browse, birds, beaver

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	5,000-8,000', mountain streams, lakes and other moist sites
RANGE SITES:	Wasatch and Uinta Mountains
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Poor
WIND FIRM:	Moderate
ASPECT:	All, streamside
SOIL:	

TEXTURE:	Medium to coarse
pH:	6.0 - 7.0
DEPTH:	Deep
MOISTURE:	Moist
ORGANIC MATTER:	Yes, if possible
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Clean, carefree; may have weak wood
INSECTS:	91 on genus
DISEASES:	12 on species

PLANT LIST

SCIENTIFIC NAME: Salix scouleriana COMMON NAME: Scouler Willow

TYPE:	Deciduous tree-shrub
ULTIMATE HEIGHT:	9-12' (2.7-3.6m)
ULTIMATE SPREAD:	10' (3m)
FORM:	Shrub, rounded crown, tree
TEXTURE:	Medium
TWIGS:	Stout, terete, yellow or reddish, pubescent at first, later brown, glabrous
BARK:	Reddish brown to blackish, thin
LEAF DESCRIPTION:	Oblanceolate 2-3" long entire to serrulate
LEAF COLOR:	Dark green summer, yellow autumn
FLOWER COLOR:	Staminate catkins: 1" yellowish-white
FLOWER TIME:	Spring
FRUIT:	Pistillate catkins 2" reddish, capsule
ROOT TYPE:	Fibrous, spreading
LIFE SPAN:	Short
POISONOUS:	Not poisonous

USE

BEST USE:	In mass as a background or screen ornamental, stream erosion control, one of first to invade burned areas
PALATABILITY:	Deer, elk, beaver, small mammals, birds; sheep cattle

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	6,000-10,000', edges of creeks, spring and moist areas
RANGE SITES:	High mountain sites of Utah
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Poor
WIND FIRM:	Yes
ASPECT:	All, streamside
SOIL:	

TEXTURE:	Medium
pH:	6.5 - 7.0
DEPTH:	Deep
MOISTURE:	Moist or dry
ORGANIC MATTER:	No
DRAINAGE:	Wet, well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Clean, carefree
INSECTS:	91 on genus
DISEASES:	Many on genus

PLANT LIST

SCIENTIFIC NAME: Salix wolfii COMMON NAME: Wolfs Willow

TYPE:	Deciduous shrub
ULTIMATE HEIGHT:	3' (1m)
ULTIMATE SPREAD:	3-4' (1-1.3m)
FORM:	Low round shrub in thickets
TEXTURE:	Fine-medium
TWIGS:	Slender and round with bark that loosens easily, smooth
BARK:	Yellow to orange young, brown old, furrows and ridges
LEAF DESCRIPTION:	1" oblanceolate, acute tip, entire
LEAF COLOR:	Dull green summer, yellow-green autumn
FLOWER COLOR:	Staminate catkins 1/2" small yellowish
FLOWER TIME:	Spring
FRUIT:	Capsule
ROOT TYPE:	Spreading fibrous
LIFE SPAN:	Short
POISONOUS:	Not poisonous

USE

BEST USE:	Water sides, mass in background, stream erosion control
PALATABILITY:	Moose, elk, deer, small mammals and birds, sheep, cattle

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	4,000-9,000', mountain stream bottom sites
RANGE SITES:	Information not available
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Poor
WIND FIRM:	Yes
ASPECT:	All, streamside, north at lower elevations
SOIL:	

TEXTURE:	Medium
pH:	6.5 - 7.0
DEPTH:	Moderate
MOISTURE:	Moist to wet
ORGANIC MATTER:	No
DRAINAGE:	Wet to boggy

ESTABLISHMENT

TRANSPLANTABILITY:	Good
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Clean, carefree
INSECTS:	91 on genus
DISEASES:	Many on genus

PLANT LIST

SCIENTIFIC NAME: Sambucus caerulea COMMON NAME: Blueberry Elderberry

TYPE:	Deciduous shrubs
ULTIMATE HEIGHT:	6-18' (1.8-5.4m)
ULTIMATE SPREAD:	5-8' (1.5-2.4m)
FORM:	Shrub or small tree; crown is rounded individual trees, clumps are vase-shaped
TEXTURE:	Medium to coarse
TWIGS:	Stout, angular, green to reddish-brown
BARK:	Vertical, thin and furrowed, gray
LEAF DESCRIPTION:	5-9 leaflets 2-4", lanceolate, pinnately compound
LEAF COLOR:	Green yellow, summer, brown to purple, autumn
FLOWER COLOR:	Small, white, in cymes
FLOWER TIME:	April - July
FRUIT:	Small blue-black drupe in cymes
ROOT TYPE:	Fibrous, spreading
LIFE SPAN:	Short
POISONOUS:	Nitrate in plant over 1.5 percent may prove lethal to livestock

USE

BEST USE:	Ornamental shrub, edible fruit, stabilizing eroding areas
PALATABILITY:	Birds, deer, elk, browse

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	5,500-8,000', river bottoms, moist sites
RANGE SITES:	Most of the mountainous areas of Utah
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Poor
WIND FIRM:	Yes
ASPECT:	All, south at lower elevations
SOIL:	

TEXTURE:	Medium to coarse
pH:	7.0
DEPTH:	Deep
MOISTURE:	Moist, dry
ORGANIC MATTER:	Yes
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good
PLANTING TIME:	Information not available

MANAGEMENT

MAINTENANCE:	Clean, subject to breakage
INSECTS:	2 on species
DISEASES:	10 on species

PLANT LIST

SCIENTIFIC NAME: Sambucus microbotrys COMMON NAME: Elderberry

TYPE:	Deciduous shrubs
ULTIMATE HEIGHT:	12' (3.6m)
ULTIMATE SPREAD:	5-6' (1.5-1.8m)
FORM:	Shrub, rounded to irregular; clump of stems
TEXTURE:	Medium to coarse
TWIGS:	Information not available
BARK:	Rank odor
LEAF DESCRIPTION:	5-7 leaflets 2-4", ovate, lanceolate, serrate, pinnately compound
LEAF COLOR:	Green, summer, purple to brown autumn
FLOWER COLOR:	White-yellowish, small, in cymes
FLOWER TIME:	Summer
FRUIT:	Drupes, orange-red, in cymes
ROOT TYPE:	Fibrous spreading
LIFE SPAN:	Short
POISONOUS:	Nitrate in plant over 1.5 percent may prove lethal to livestock

USE

BEST USE:	Background foliage, erosion control
PALATABILITY:	Birds, browsed by deer, elk, cattle and sheep

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	6,000-11,000', river bottoms, moist sites
RANGE SITES:	Information not available
EXPOSURE:	Shade, sun
DROUGHT TOLERANCE:	Poor
WIND FIRM:	Yes
ASPECT:	All
SOIL:	

TEXTURE:	Medium to coarse
pH:	7.0
DEPTH:	Moderate
MOISTURE:	Moist
ORGANIC MATTER:	Yes, if possible
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Clean, carefree, suckers
INSECTS:	3 on genus
DISEASES:	7 on species

PLANT LIST

SCIENTIFIC NAME: Sarcobatus vermiculatus COMMON NAME: Greasewood

TYPE:	Deciduous shrub
ULTIMATE HEIGHT:	3-8' (1-2.4m)
ULTIMATE SPREAD:	Information not available
FORM:	Rounded erect or spreading shrub, spiny branches
TEXTURE:	Fine
TWIGS:	Older gray, younger yellowish-white, glabrous
BARK:	Gray
LEAF DESCRIPTION:	Fleshy, linear .5-1"
LEAF COLOR:	Yellow-green to green
FLOWER COLOR:	Inconspicuous, green
FLOWER TIME:	May - August
FRUIT:	Achene
ROOT TYPE:	Information not available
LIFE SPAN:	Information not available
POISONOUS:	Sodium oxalate and potassium oxalate in plant are lethal to livestock

USE

BEST USE:	Roadside seeding and beautification in saline-alkali areas
PALATABILITY:	Browse

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	3,000-7,000', semi-desert and desert regions
RANGE SITES:	Juab, Millard and Beaver
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Information not available
ASPECT:	Information not available
SOIL:	Saline and alkaline soils

TEXTURE:	Clay to coarse
pH:	8.0
DEPTH:	Information not available
MOISTURE:	6-12" precipitation
ORGANIC MATTER:	Information not available
DRAINAGE:	Information not available

ESTABLISHMENT

TRANSPLANTABILITY:	Yes
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Carefree/clean
INSECTS:	8 on genus
DISEASES:	None

PLANT LIST

SCIENTIFIC NAME: Shepherdia argentea COMMON NAME: Silver Buffaloberry

TYPE:	Deciduous shrub
ULTIMATE HEIGHT:	6-21' (1.8-6.4m)
ULTIMATE SPREAD:	10' (3.0m)
FORM:	Tall shrub, thicket forming
TEXTURE:	Medium
TWIGS:	Thorny
BARK:	Silver when young
LEAF DESCRIPTION	2" oblong, entire
LEAF COLOR:	Silver, summer, brown, autumn
FLOWER COLOR:	Inconspicuous
FLOWER TIME:	Spring
FRUIT:	Small, round, golden or red berry
ROOT TYPE:	Suckering
LIFE SPAN:	Short
POISONOUS:	Not poisonous

USE

BEST USE:	Barrier, color contrast, useful erosion control
PALATABILITY:	Information not available.

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	4,500-7,500', streamside
RANGE SITES:	Information not available
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Poor
WIND FIRM :	Yes
ASPECT:	All
SOIL:	

TEXTURE:	Medium to coarse or fine
pH:	7.0 - 8.0
DEPTH:	Deep
MOISTURE:	Moist
ORGANIC MATTER:	No
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good
PLANTING TIME:	Information not available

MANAGEMENT

MAINTENANCE:	Clean, carefree
INSECTS:	1 on genus
DISEASES:	13 for genus

PLANT LIST

SCIENTIFIC NAME: Sorbus scopulina COMMON NAME: Greene's Mountain Ash

TYPE:	Deciduous shrub
ULTIMATE HEIGHT:	12-15' (3.6-4.5m)
ULTIMATE SPREAD:	5-10' (1.5-3m)
FORM:	Semi-erect shrub, branching from base, small tree, or thicket-forming
TEXTURE:	Medium
TWIGS:	Information not available
BARK:	Smooth, thin, yellow brown young, dark brown-gray older
LEAF DESCRIPTION:	1" leaflets, pinnately compound, serrate
LEAF COLOR:	Green, summer, Red-orange autumn 9-15 leaflets finely toothed
FLOWER COLOR:	White in large racemes
FLOWER TIME:	Spring, June
FRUIT:	3-4" heads of red orange berrylike
ROOT TYPE:	Underground suckers, heavy, layering
LIFE SPAN:	Short to moderate
POISONOUS:	Not poisonous

USE

BEST USE:	Ornamental shrub
PALATABILITY:	Birds, good sheep feed

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	6,000-10,000', moist canyon bottoms or rocky mountain slope
RANGE SITES:	Information not available
EXPOSURE:	Sun or shade
DROUGHT TOLERANCE:	Poor
WIND FIRM:	Yes
ASPECT:	All, north of lower elevations
SOIL:	Sandy, gravel

TEXTURE:	Medium to coarse, loamy
pH:	6.0 - 7.0
DEPTH:	Deep
MOISTURE:	Moist
ORGANIC MATTER:	Yes
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Only if young
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Clean, carefree
INSECTS	16 on genus
DISEASES:	48 on genus

PLANT LIST

SCIENTIFIC NAME: Symphoricarpos longiflorus COMMON NAME: Longflower Snowberry

TYPE:	Deciduous Shrub
ULTIMATE HEIGHT:	1 1/2-2' (.4-.6m)
ULTIMATE SPREAD:	3' (1m)
FORM:	Low shrub, spreading shrub
TEXTURE:	Fine
TWIGS:	Young twigs glaucous, glabrous, or sparsely pubescent
BARK:	Exfoliating, young glaucous
LEAF DESCRIPTION:	Small lanceolate or oval leaves, entire glabrate
LEAF COLOR:	Pale green summer, brown autumn
FLOWER COLOR:	Pink, salverform
FLOWER TIME:	May - June
FRUIT:	Berrylike drupe with nutlets
ROOT TYPE:	Fibrous, spreading
LIFE SPAN:	Short
POISONOUS:	Not poisonous

USE

BEST USE:	Low shrub, possible erosion control
PALATABILITY:	Birds

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	4,500-7,000', dry slopes
RANGE SITES:	Information not available
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Moderate
WIND FIRM:	Yes
ASPECT:	All
SOIL:	Limestone

TEXTURE:	Medium to rocky
pH:	7.0 - 8.0
DEPTH:	Moderate to deep
MOISTURE:	Dry - 8-14" precipitation
ORGANIC MATTER:	No
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good when young
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Clean, carefree
INSECTS:	11 for genus
DISEASES:	None

PLANT LIST

SCIENTIFIC NAME: Symphoricarpos oreophilus COMMON NAME: Western Snowberry

TYPE:	Deciduous shrub
ULTIMATE HEIGHT:	3' (1m)
ULTIMATE SPREAD:	3' (1m)
FORM:	Small, stoloniferous shrub, nicely shaped
TEXTURE:	Fine
TWIGS:	Stems, pubescent, much-branched
BARK:	Pubescent, grayish to reddish shreddy
LEAF DESCRIPTION:	Small, smooth, thin oval, opposite sessile
LEAF COLOR:	Green or gray green summer, brown autumn
FLOWER COLOR:	1/2" white-pink, small
FLOWER TIME:	June - July
FRUIT:	White, berrylike drupe
ROOT TYPE:	Stolonferous, fibrous
LIFE SPAN:	Short (regenerates)
POISONOUS:	Not poisonous

USE

BEST USE:	Specimen or in mass, ornamental, excellent erosion control plant
PALATABILITY:	Deer browse, rodents, birds

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	6,300-9,000', information not available
RANGE SITES:	Information not available
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Moderate if well-established
WIND FIRM:	Yes
ASPECT:	All, north at lower elevations
SOIL:	

TEXTURE:	Medium
pH:	7.0
DEPTH:	Moderate
MOISTURE:	Moist 12-40" precipitation
ORGANIC MATTER:	Information not available
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Good when young
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Clean, carefree, may sucker
INSECTS:	11 on genus
DISEASES:	7 on species

PLANT LIST

SCIENTIFIC NAME: Tetradymia canescens COMMON NAME: Gray Horsebrush

TYPE:	Deciduous Shrub
ULTIMATE HEIGHT:	1-3' (.3-.9m)
ULTIMATE SPREAD:	Information not available
FORM:	Freely branched, sometimes curved downward towards tips
TEXTURE:	Fine
TWIGS:	White tomentum, stiff, much branched
BARK:	Information not available
LEAF DESCRIPTION:	White-tomentose
LEAF COLOR:	White
FLOWER COLOR:	Yellow
FLOWER TIME:	July - August
FRUIT:	Achene
ROOT TYPE:	Information not available
LIFE SPAN:	Information not available
POISONOUS:	Plants cause sensitization of livestock to sunlight, it may also damage liver

USE

BEST USE:	Some adaptation for roadside seeding, rest stops, erosion control
PALATABILITY:	Deer Browsed

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	4,000-8,000', information not available
RANGE SITES:	Information not available
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Information not available
ASPECT:	Information not available
SOIL:	

TEXTURE:	Information not available
pH:	May be on slightly saline-alkaline soil
DEPTH:	Information not available
MOISTURE:	4-12" precipitation
ORGANIC MATTER:	Information not available
DRAINAGE:	Information not available

ESTABLISHMENT

TRANSPLANTABILITY:	Information not available
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Information not available
INSECTS:	None
DISEASES:	None

PLANT LIST

SCIENTIFIC NAME: Yucca baccata COMMON NAME: Spanish Bayonet

TYPE:	Evergreen shrub
ULTIMATE HEIGHT:	(3-10 cm)
ULTIMATE SPREAD:	Information not available
FORM:	Simple, stemless or in clumps with 2-6 short procumbent stems
TEXTURE:	Coarse
TWIGS:	None
BARK:	None
LEAF DESCRIPTION:	Stemless fibrous, thick
LEAF COLOR:	Gray-green
FLOWER COLOR:	Red-purple tinge
FLOWER TIME:	May - June
FRUIT:	Ellipsoid, fleshy
ROOT TYPE:	Tap root
LIFE SPAN:	Information not available
POISONOUS:	Not poisonous

USE

BEST USE:	Sometimes used as ornamentals
PALATABILITY:	Browsed by deer

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	3,000-4,000', dry wash, dry slopes
RANGE SITES:	Southwestern part of Utah, Washington County
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	Southwest slopes
SOIL:	Loam

TEXTURE:	Medium
pH:	On limestone soil
DEPTH:	Information not available
MOISTURE:	Dry slopes, 6" precipitation
ORGANIC MATTER:	Information not available
DRAINAGE	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Information not available
PLANTING TIME:	Spring

MANAGEMENT

MAINTENANCE:	Clean
INSECTS:	9 on genus, pronuba moth essential to pollination
DISEASES:	17 on nonarborescent group

PLANT LIST

SCIENTIFIC NAME: Yucca brevifolia COMMON NAME: Joshua Tree Yucca

TYPE:	Evergreen
ULTIMATE HEIGHT:	13-20' (4-6m)
ULTIMATE SPREAD:	Information not available
FORM:	Small tree, grotesque branching, crown somewhat rounded, broad and open
TEXTURE:	Coarse
TWIGS:	Inconspicuous, covered with dried up leaves that fold down the stems, armlike
BARK:	Dark brown, broken into thin plates
LEAF DESCRIPTION:	Sword-like evergreen, 6-10" long, 1/2" width, stiff, flattened and sharp-pointed, margins finely toothed.
LEAF COLOR:	Blue-green, green
FLOWER COLOR:	Yellowish, spike-like clusters, flower 2" long
FLOWER TIME:	April - May
FRUIT:	Small, formed in egg-shaped capsules about 3" long
ROOT TYPE:	Information not available
LIFE SPAN:	Old
POISONOUS:	Not poisonous

USE

BEST USE:	Ornamental use
PALATABILITY:	Poor browser

ADAPTATIONS

ELEVATION AND TOPOGRAPHY:	2,000-3,500', mountain sides and valley bottoms
RANGE SITES:	In Utah, lower Virgin River Valley and Beaver Dam, Washington, County
EXPOSURE:	Sun
DROUGHT TOLERANCE:	Good
WIND FIRM:	Yes
ASPECT:	Mojave Desert, dry mesas and slopes, south
SOIL:	Gravelly or sandy
TEXTURE:	Medium to fine
pH:	Information not available
DEPTH:	Deep
MOISTURE:	Very little
ORGANIC MATTER:	Information not available
DRAINAGE:	Well-drained

ESTABLISHMENT

TRANSPLANTABILITY:	Seedlings
PLANTING TIME:	November

MANAGEMENT

MAINTENANCE:	Clean
INSECTS:	9 on genus, 1 at least beneficial, pronuba moth for pollination
DISEASES:	14 on genus

PLANT LIST

SCIENTIFIC NAME: Agropyron desertorum COMMON NAME: Desert Wheatgrass

TYPE: Grass

PLANT DESCRIPTION: Perennial; leaves flat, smooth below, slightly harsh above; stalks erect, in dense tuft 2 to 3 feet (.6 to .9 m) leafy; seed-head long, 1.5 to 3 inches (3.8 to 7.6 cm), sometimes nodding

ROOT TYPE: Fibrous, lacking rootstock, bunchgrass

USE

EROSION CONTROL: Bunchgrass, only moderately good for erosion control; better results on arid sites

PALATABILITY: Good feed for cattle, sheep and horses; fair to choice forage elk, deer and antelope

ADAPTATION

TOPOGRAPHY: Upland range sites and semi-desert range sites

SOIL: Adapts to wide range of soils, does best on deep, medium textured soils; moderately high tolerance to salt and alkali

MOISTURE: 10 to 14 inches annual precipitation

ESTABLISHMENT

PLANTING: Seeded by drill, hydro processes or broadcasting seed; fast growing, hardy and fire tolerant; planting time late fall or early winter

REMARKS

This grass is an introduced species but has become so well established it is considered naturalized

PLANT LIST

SCIENTIFIC NAME: Agropyrom smithii COMMON NAME: Western Wheatgrass

TYPE: Grass

PLANT DESCRIPTION: Vigorous perennial with creeping rootstalks and coarse foliage; usually glaucous with erect stems 12 to 30 inches (30.5 to 76.2 cm) tall. Seedheads narrow spikes, erect, mostly 3 to 6 inches (7 to 15 cm) long

ROOT TYPE: Rhizomes, sod forming

USE

EROSION CONTROL: Rhizomes spread creating an open but uniform sod that protects soil from erosion

PALATABILITY: Young growth palatable to cattle and sheep, fair to choice forage for elk, deer and antelope

ADAPTATION

TOPOGRAPHY: Dry hills, bottomlands, fields and forest openings. Elevation 3,000 to 9,000 feet

SOIL: Moist, alkaline soil, occurring most frequently on moderately fine and fine textured soils

MOISTURE: 8 inches annual precipitation required, in temperate climates established stands can endure long periods of drought

ESTABLISHMENT

PLANTING: Seeded by drill or hydroprocess, fast growing, hardy and fire tolerant; planting time, late fall or early spring

PLANT LIST

SCIENTIFIC NAME: Agropyron spicatum COMMON NAME: Bluebunch Wheatgrass

TYPE: Grass

PLANT DESCRIPTION: Perennial grass; numerous leaves, fine, narrow, flat or rolled, 5 to 12 inches (12.7 to 30.5 cm); color, pale green to bluish, stalks erect, slender, 12 to 36 inches (30.5 to 91.4 cm) tall; seedheads slender spikes, 5 to 8 inches (12.7 to 20 cm) long

ROOT TYPE: No rhyzomes, varies from a distinct bunchgrass to a weak sod former

USE

EROSION CONTROL: Excellent erosion control plant if associated with other native plants

PALATABILITY: Excellent forage for sheep, cattle and horses; elk and deer forage during winter and spring, antelope forage moderately in spring

ADAPTATIONS

TOPOGRAPHY: Open areas, mostly south or west slopes or droughty ridgetops

SOIL: Well-drained, medium to coarse textured soils; excellent adaptation to granitic soils; intolerant to salty or alkaline soils

MOISTURE: 8 inches annual precipitation required, drought tolerants; intolerant to excess moisture accumulation

ESTABLISHMENT

PLANTING: Seeded by drill or hydro process, slow to establish hardy and fire tolerant; planting time late fall or early spring

PLANT LIST

SCIENTIFIC NAME: Bouteloua gracilis COMMON NAME: Blue Grama

TYPE: Grass

PLANT DESCRIPTION: Perennial, sometimes forming sod-like patches; leaves 3 to 6 inches (7.6 to 15.2 cm), grayish green curing to gray or yellow, often curled; stocks slender, erect, generally 10 to 20 inches (25.4 to 50.8 cm); seedheads one sided, comblike curved spikes 1 to 3 inches (2.5 to 7.6 cm)

ROOT TYPE: Fibrous, spreading

USE

EROSION CONTROL: Excellent soil protection due to its fibrous, spreading root system and sod-like growth habit

PALATABILITY: Choice feed for sheep, cattle and horses; fair feed for deer, small mammals and rodents

ADAPTATION

TOPOGRAPHY: Dry plains and hillsides, open sites, sites with pinion and juniper, southern half of Utah, 4,000 to 8,000 feet

SOIL: Grows on wide range of soils, sandy, gravelly soils to fine textured, shallow to deep; adapted to soils high in lime, gravel, cobble or stone

MOISTURE: Annual precipitation 6 to 17 inches; a warm-season plant

ESTABLISHMENT

PLANTING: Seeding by drill or hydroprocesses, low germination, hardy and fire tolerant; planting time late fall or early spring

PLANT LIST

SCIENTIFIC NAME: Elymus glaucus COMMON NAME: Blue Wildrye

TYPE: Grass

PLANT DESCRIPTION: Perennial bunchgrass, short-lived; leaves flat, glaucus to glabrous; stalks erect to semi-erect loose to dense tufts, 2 to 4 feet (.6 to 1.2 m); seedhead long, 3.5 to 6 inches (8.8 to 15.2 cm), somewhat nodding

ROOT TYPE: No rhizomes

USE

EROSION CONTROL: Primarily an erosion-controlling cover on burned over and cut-over timber areas

PALATABILITY: Good summer grasing for cattle, fair for sheep, good forage for elk and deer

ADAPTATION

TOPOGRAPHY: Shade-tolerant, adapted to favorable sites in or near open timbered or brushy areas; 6,500 to 10,000 feet

SOIL: Moist

MOISTURE: 18 inches annual precipitation

ESTABLISHMENT

PLANTING: Seeded by drill, hydro processes or broadcasting seed, fast growing; planting time late fall

PLANT LIST

SCIENTIFIC NAME: Festuca ovina COMMON NAME: Sheep Fescue

TYPE: Grass

PLANT DESCRIPTION: Perennial; leaves slender, involute, from very scabrous to glabrous; stalk semi-erect, densely tufted 8 to 16 inches (20 to 40 cm) tall; seedheads 2 to 4 inches (5 to 10 cm) almost spikelike

ROOT TYPE: Numerous, finely fibrous, lacking rootstocks

USE

EROSION CONTROL: Soil protection on roadsides and ditchbanks; fairly drought resistant

PALATABILITY: Valuable forage grass for all class of livestock

ADAPTATION

TOPOGRAPHY: Open hillsides, benchlands, meadows, open woodlands and lightly timbered areas

SOIL: Sandy or gravelly and rather poor, will not tolerate saline-alkali soils

MOISTURE: Fairly resistant to drought; annual precipitation, information not available

ESTABLISHMENT

PLANTING: Seeded by drill or broadcast; slow to develop, planting time early spring

PLANT LIST

SCIENTIFIC NAME: Oryzopsis hymenoides COMMON NAME: Indian Ricegrass

TYPE: Grass

PLANT DESCRIPTION: Densely tufted perennial, leaves slender, 6 to 15 inches (15.2 to 38.1 cm) long; flat or inrolled, stiff; stalks erect, rigid, 1 to 2 feet (.3 to 0.6 m) tall; seedhead long, 6 to 12 inches (15.2 to 30.5 cm), branched in pairs, very loose, zigzag or wavy

ROOT TYPE: Fibrous, numerous, deep, extensive

USE

EROSION CONTROL: Medium resistance to erosion if associated with other natives

PALATABILITY: Excellent forage for sheep, cattle, and horses; not readily used by big game, good feed for rabbits, rodents and birds

ADAPTATION

TOPOGRAPHY: Desert and semidesert, foothills, ridges and dry, rocky mountain slopes from 4,000 to 7,000 feet

SOIL: Found on variety of soils; sandy, clay and shallow shale soils; found on deep to very shallow soil; soil high in lime

MOISTURE: 5 to 12 inches, annual precipitation; very drought enduring

ESTABLISHMENT

PLANTING: Seed by drill or hydro process, hardy and fire tolerant

PLANT LIST

SCIENTIFIC NAME: Poa fendleriana COMMON NAME: Muttongrass

TYPE: Grass

PLANT DESCRIPTION: Perennial; leaves mostly folded, mostly basal, pale bluish green 2 to 12 inches (5 to 30.5 m); stock erect, densely tufted, 1 to 2 feet (.3 to .6 m) tall; seedheads loose 1 to 4 inches (2.5 to 10 cm), narrow, erect or slightly nodding

ROOT TYPE: Numerous, fibrous; lacking long-running rootstocks

USE

EROSION CONTROL: Deep fibrous root system provided excellent erosion control

PALATABILITY: Excellent feed for cattle, horses and sheep; good forage plant for elk and deer

ADAPTATION

TOPOGRAPHY: Mountain slopes and ridges, open timber and well-drained meadows; maximum elevation, 10,000 feet

SOIL: Prefer deep loamy soils but are found on clay loams to sand

MOISTURE: 8 to 25 inches annual precipitation

ESTABLISHMENT

PLANTING: Seeded by drill; germination test show low viability; planting time late fall or early spring

PLANT LIST

SCIENTIFIC NAME: Poa secunda COMMON NAME: Sandberg Bluegrass

TYPE: Grass

PLANT DESCRIPTION: Perennial; leaves short basal tuft, curly at maturity, 2 to 6 inches (5 to 15.2 cm), blades very narrow, short and soft; stalks erect, 6 to 30 inches (15.2 to 76.2 cm); seedheads very narrow, up to 4 inches (10.1 cm) long

ROOT TYPE: Fibrous; lacking creeping rootstocks

USE

EROSION CONTROL: Coarse fibrous roots protect soil from erosion

PALATABILITY: Good spring and fall forage grass for all classes of livestock; grazed readily by deer and elk

ADAPTATION

TOPOGRAPHY: Semidesert areas, foothills, grassy slopes, ridge tops and well-drained areas; elevation 4500 to 9000 feet

SOIL: Occurs on soil from shallow to deep, clay to coarse gravelly, stoney or cobbly; usually on shallow, dry, rocky soils with medium texture

MOISTURE: 6 to 25 inches annual precipitation

ESTABLISHMENT

PLANTING: Planting time fall; other information not available

REMARKS

This grass is an introduced species but has become so well established it is considered naturalized

PLANT LIST

SCIENTIFIC NAME: Sporobolus airoides COMMON NAME: Alkali Sacaton

TYPE: Grass

PLANT DESCRIPTION: Perennial; leaves wide at base, tapering to a long slender point; sheaths smooth; stock erect, 1 to 3 feet tall, (.3 to .9 m), smooth, solid; seedheads spreading, pyramidal, 4 to 16 inches (10 to 40.6 cm) long

ROOT TYPE: Fibrous, coarse, deep

USE

EROSION CONTROL: Plants deep, coarse roots and stooling characteristics, and ability to withstand shifting sand and wilt make an excellent erosion control plant

PALATABILITY: Readily eaten by sheep, cattle and horses; not readily used by big game, good feet for rabbits and rodents

ADAPTATION

TOPOGRAPHY: Found in deserts and semidesert sites; alkali bottoms, salt meadows, and semi-wet meadows

SOIL: Endures saline-alkali soils; deep, silty, stony, gravelly and cobbly

MOISTURE: Saline and alkaline water tables; 6 to 12 inches annual precipitation

ESTABLISHMENT

PLANTING: Seed by drill or hydroprocess, hardy and fire tolerant

PLANT LIST

SCIENTIFIC NAME: Sporobolus cryptandrus COMMON NAME: Sand Dropseed

TYPE: Grass

PLANT DESCRIPTION: Tufted perennial, warm season bunchgrass; leaves flat or foled, somewhat rigid, bluish green curing to light yellow; stalks unbranched, solid, 1 to 2.5 feet (.3 to .76 m); seedhead narrow but loosely flowered, dark-colored, 4 to 7 inches (10 to 17.7 cm)

ROOT: Fibrous

USE

EROSION CONTROL; Information not available

PALATABILITY: Fair to good forage grass for all classes of livestock during early growth, relatively unpalatable when dry

ADAPTATION

TOPOGRAPHY: Sandy hillsides and desert regions appeals at lower elevations, 8,000 feet above sea level and below

SOIL: Sandy

MOISTURE: 8 inches annual precipitation

ESTABLISHMENT

PLANTING: Seed by drill or hydro process, hardy and fire tolerant; planting time late June or early July

Scientific Name Index

Trees and Shrubs

Common Name Index

Trees and Shrubs (Continued)

CHAPTER IV

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

At the present time, the State of Utah utilizes mainly non-indigenous species for highway revegetation and planting. Although there has been some use of native plants for revegetation and planting, no extensive research has been undertaken to determine what native plants could be used.

The purpose of this thesis was to explore the possibility and desirability of using native plant materials for the planting of highways in Utah. Secondly, a list of native plants suitable for highway planting was developed which consolidated the known information pertaining to the plant. A matrix, for quick reference, was then developed showing the plant names and general characteristics.

To achieve the purpose of this study, the following objectives were accomplished:

First, a survey was conducted to determine if native plants were being utilized for highway plantings in Utah and neighboring states which have similar climatic and edaphic conditions (Idaho, Colorado, Nevada, New Mexico and Arizona).

Personal interviews with UDOT personnel, revealed that there has been some use of native plant materials for highway planting in Utah, but due to the limitation of native stock and seed, no comprehensive studies have been undertaken. Since the start of this thesis, UDOT

has used native plants for the purposes of revegetating and planting a small section of Interstate Two-Fifteen in Salt Lake City. The stock that was used for this planting was grown in small tube-like containers, consequently, it will take several years before the success of the project can be evaluated. In states surrounding Utah native plant materials have been used for highway planting. Arizona and Nevada have done research to determine which native plants could be used for highway planting in their states. Idaho, Wyoming and New Mexico have utilized native grasses and shrubs for the purpose of highway planting and revegetation.

Second, it was determined what various authors have advocated the use of native plant materials for highway planting. A review of literature was completed which expressed the feelings of different authors. The American Association of State Highway Transportation Officials, Crowe, White, Tunnard and Pushkarev all recommended that native plant material should be used in highway planting in order to achieve a natural appearance, to lower maintenance costs, for self propagation of plants and for erosion control.

Third, factors that influence the survivability of a plant in the highway environment were compiled through a review of literature. The findings of various authors, Kuchler, Hunt, Bannister, Oosting and Geiger concerning macroclimate, microclimate and environmental factors as they affect highway plantings in Utah were discussed. Also AASHTO standards for highway plantings were reviewed. This information is important because it describes the ecological survivability and maintenance efficiency of highway plantings.

Fourth, a systematic evaluation of a predetermined section of highway was conducted. The evaluation included a description of the environmental characteristics of the site and an evaluation of the existing plant material, both species planted by UDOT and native to the area. The case study site was located in the north central portion of Utah. Two projects were evaluated to determine the survival rate of plant material being used by UDOT. This study documented the need to use native plants in Utah. It was determined that plants used for planting designs by UDOT were not showing a good response. Plants on Interstate Fifteen, which had a manual irrigation system were below a 50 percent survival rate, with the exception of *Juniperus virginiana canaertii*, *Elaeagnus angustifolia*, *Fraxinus pennsylvanica lanceolota* and *Pinus nigra* which had higher survival rates. On Interstate Eighty-North, only *Rhus glabra*, which is a native species showed a reasonable percent of survival. The species which had a high survival rate on Interstate Fifteen were not surviving well on Interstate Eighty-North. Interstate Eighty-North had only a 90-day hand watering period for initial establishment and no irrigation system.

From this, it can be concluded that maintenance, especially irrigation is a key factor for the survivability of the exotic plant species used by UDOT.

The cost data from the study showed that on Interstate Fifteen plant loss was 16 percent of total while on Interstate Eighty-North plant loss was 67 percent of total. The survival rates of plants appear to be attributed to irrigation, choice of plant material and maintenance practices.

In contrast to the planting by the UDOT, native plant material which existed on both sites were self-propagating and were well established. These plants had not been planted, but had reestablished naturally on the site.

Fifth, a list of native plants was formulated for use as an alternative to the exotic species presently being used by UDOT. The list does not include every species which could be used for highway planting, but represents the better known and adaptable native plants of Utah.

Conclusions

From the evidence provided in this study, native plants show promise for growing in the highway environment whereas nonindigenous species appear to need irrigation and other maintenance in order to survive.

The present plant selection and maintenance practices are not producing acceptable survival rates with plants presently utilized for revegetation. The lack of economic efficiency in man power, materials and capital expenditures seems to clearly indicate that alternative methods and criteria be adopted for the selection of plants by UDOT.

The only reasonable alternative available would be to utilize indigenous plant species which are adapted to the climatic zones in which the highway is located. The methods for proper selection of such species will depend upon an appraisal of the ecological factors such as soil, temperature, precipitation, elevation and exposure, which influence plant growth.

Recommendations

Highway personnel, nurserymen, environmental specialists, range scientists and botanists all expressed to the author that there are problems with the present plantings and revegetation practices being used by UDOT. An alternative answer to this problem may be to utilize native plants. It is apparent that UDOT is conscious of the problem but will not solve it by reducing the highway landscaping personnel or ignoring the problem. Appropriate steps should be taken to develop a selection of native plants for highway planting.

A list of potential native plants suitable for highway planting has been compiled in this study. It is recommended that plants be chosen from this list and be tested in the highway environment. Experimental sites should be established in each of the three Utah climate zones. The environmental characteristics of the sites should be studied to determine which native plants are suitable for the particular sites. Experiments should be conducted utilizing various amounts of irrigation, different planting methods and maintenance practices. Systematic records for each site should be kept. This would determine which species require the minimum amount of irrigation and maintenance. This type of study will provide the necessary data to determine which native species are best suited to the highway environment in the different climate zones in Utah.

LIST OF REFERENCES

American Association of Nurserymen. 1967. 1st Technical Beautification Clinic. The Association, Washington, D. C.

American Association of State Highway Transportation Officials. 1973. A Policy on Design of Urban Highways and Arterial Streets. The Association, Washington, D. C.

_____. 1970. A Guide for Highway Landscape and Environmental Design. The Association, Washington, D.C.

_____. 1959. A Policy on Geometric Design of Rural Highways. The Association, Washington, D.C.

Bannister, Peter. 1976. Introduction to Physiological Plant Ecology. Blackwell Scientific Publications, Oxford, London, Edinburgh, Melbourne.

Benton, A. H. and Werner, W. E., Jr. 1974. Field Biology and Ecology. McGraw-Hill, New York, New York.

Brewster, S., ed. 1959. The Highway and the Landscape. Rutgers University Press, New Brunswick, New Jersey.

Crowe, S. 1960. The Landscape of Roads. The Architectural Press, London.

Daubenmire. 1959. Plants and Environment. John Wiley & Sons, Inc., New York.

Edmunson, George C. 1976. Plant Materials Study. USDA S.C.S. LPMC-1. USDA, Soil Conservation Service, Davis, California.

Gates, D. M. 1973. Man and His Environment: Climate. Harper and Row, New York.

Geiger, Rudolf. 1965. The Climate Near the Ground. Harvard University Press, Cambridge, Mass.

Griffiths, John F. 1976. Climate and the Environment. Westview Press, Boulder, Colorado.

Harris, Richard W. 1971. Establishment of Woody Plants by Direct Seeding in California. State of California, Transportation Agency, Division of Highways.

Harrison, Bertrand F. 1939. An Annotated List of Utah Grasses. Utah Academy of Sciences, Arts, and Letters. Vol. XVI.

Hitchcock, A. S. 1950. Manual of the Grasses of the United States. USDA Miscellaneous Publication No. 200.

Holmgren, A. H. and Reveal, J. L. 1966. Checklist of the Vascular Plants of the Inter-Mountain Regions. Intermountain Forest and Range Exp. Station, Ogden, Utah.

Hunt, Charles B. 1967. Physiography of the United States. W. H. Freeman and Co., San Francisco and London.

Institute for Land Rehabilitation. 1977. Rehabilitation of Western Wildlife Habitats. Report to U.S. Fish and Wildlife Service by the Western Energy and Land Use Team. (Mimeographed)

Johnson, C. 1970. Common Native Trees of Utah. Utah State University Special Report No. 22. Logan, Utah.

Kelly, G. W. 1957. How to Have Good Gardens in the Sunshine States. Smith-Brooks Printing Co., Copyright 1958, Littleton, Colorado.

_____. 1970. A Guide to the Woody Plants of Colorado. Pruell Publishing, Boulder, Colorado.

Kimball, Erdman S. 1961. "Classification and Distribution of the Native Trees of Utah." M.S. Thesis, Brigham Young University, Provo, Utah.

Kuchler, A. W. 1964. Potential Natural Vegetation of the Conterminous United States. American Geographical Society Special Publication No. 36.

Lynch, K. 1973. Site Planning. MIT Press, Cambridge, Massachusetts.

McGowan, Joyce. 1973. "Species Recommended for Highway Plantings Selected from a Natural Vegetation Survey in the Panhandle in Nebraska." U.S. Department of Commerce, NTIS, Springfield, Va.

McKell, Cyrus M. 1976. Achieving Effective Revegetation of Disposed Processed Oil Shale: A Program Emphasizing Natural Methods in an Arid Environment. Agricultural Experiment Station, College of Natural Resources, Utah State University, Logan, Utah.

McKell, C. M. Blaisdell, J. P., Goodin, J. R., eds. 1971. Wildland Shrubs - Their Biology and Utilization. USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, Utah.

Mason, L. 1972. Facts About Poison Plants Helpful in Ranch Planning. UT. 7-L-20000-S USDA Soil Conservation Service, Salt Lake City, Utah. (mimeograph)

Mather, John. 1974. Climatology: Fundamentals and Applications. McGraw-Hill Book Co., New York.

Natural Vegetation Committee, Arizona Chapter, Soil Conservation Society of America. 1973. Landscaping with Native Arizona Plants. The University of Arizona Press, Tucson, Arizona.

Nelson, R. A. 1969. Handbook of Rocky Mountain Plants. Dale Stuart King, Publisher, Tucson, Arizona.

Olgyay, Victor. 1973. Design with Climate. Princeton University Press, Princeton, New Jersey.

Oosting, Henry. 1950. The Study of Plant Communities. W. H. Freeman and Company, San Francisco.

Plummer, P. A.; Christensen, D. R.; and Monsen, S. B. n.d. Restoring Big-Game Range in Utah. Publication 68-3, Utah Division of Fish and Game. Salt Lake City, Utah.

Robinette, Gary O. 1972. Plants/People/and Environmental Quality. U.S. Department of the Interior, National Park Service, Washington, D.C.

Robinson, F. B. 1960. Useful Trees and Shrubs. Garrard Publishing, Champaign, Illinois. (Card file) 500 cards.

Seymour, E. L. D. ed. 1941. The New Garden Encyclopedia. Wh. H. Wise & Co.

Simonds, J. O. 1961. Landscape Architecture. McGraw-Hill Book Company, New York, N. Y.

Smith, R. L. 1974. Ecology and Field Biology. Harper and Row, Publishers, New York.

Stark, N. 1966. Review of Highway Planting Information Appropriate to Nevada. University of Nevada Bulletin B-7. Reno, Nevada.

Sunset. 1971. Sunset Western Garden Book. Editors of Sunset Magazine, Menlo Park, California.

Sutton, Richard K. 1974. "An Investigation into the Design Qualities, Ecological Requirements, and Potential Use of Some Native Trees and Shrubs of the Mountains of Northeastern Utah." MLA Thesis, Utah State University, Logan, Utah.

Tunnard, C. and Pushkarev, B. 1973. Man-Made America: Chaos or Control? Yale University Press, New Haven and London.

United States Department of Agriculture. 1971. Management and Use of Alkali Sacaton. UT 7-N-20000-335. USDA Soil Conservation Service, Salt Lake City, Utah. (Mimeograph)

_____. 1971. Management and Use of Bearded Bluebunch Wheatgrass. USDA Soil Conservation Service, Salt Lake City, Utah. (Mimeograph)

_____. 1971. Management and Uses of Big Sagebrush. UT 7-N-20000-327. USDA Soil Conservation Service, Salt Lake City, Utah. (Mimeograph)

_____. 1971. Management and Uses of Birchleaf Mountain Mahogany. USDA Soil Conservation Service, Salt Lake City, Utah. (Mimeograph)

_____. 1971. Management and Uses of Bitterbrush. USDA Soil Conservation Service, Salt Lake City, Utah. (Mimeograph)

_____. 1971. Management and Uses of Black Sagebrush. UT 7-N-20000-329. USDA Soil Conservation Service, Salt Lake City, Utah. (Mimeograph)

_____. 1971. Management and Use of Blue Grama. USDA Soil Conservation Service, Salt Lake City, Utah. (Mimeograph)

_____. 1971. Management and Use of Blue Wildrye. UT 7-L-20000-340. USDA Soil Conservation Service, Salt Lake City, Utah. (Mimeograph)

_____. 1971. Management and Uses of Chokecherry. USDA Soil Conservation Service, Salt Lake City, Utah. (Mimeograph)

_____. 1971. Management and Uses of Cliffrose. UT 7-N-20000-334. USDA Soil Conservation Service, Salt Lake City, Utah. (Mimeograph)

_____. 1971. Management and Uses of Douglas Fir. USDA Soil Conservation Service, Salt Lake City, Utah. (Mimeograph)

_____. 1965. Durar Hard Fescue. 7-L-14000-193. USDA Soil Conservation Service, Salt Lake City, Utah. (Mimeograph)

_____. 1971. Management and Uses of Fourwing Saltbrush. UT 7-N-20000-338. USDA Soil Conservation Service, Salt Lake City, Utah. (Mimeograph)

_____. 1971. Management and Uses of Fringed Sagebrush. USDA Soil Conservation Service, Salt Lake City, Utah. (Mimeograph)

_____. 1971. Management and Uses of Gambel Oak. USDA Soil Conservation Service, Salt Lake City, Utah. (Mimeograph)

_____. 1968. Grasses and Legumes for Soil Conservation in the Pacific Northwest and Great Basin States. Agriculture Handbook 339, Washington, D.C. USDA.

_____. 1937. Range Plant Handbook. USDA, Forest Service, Washington, D.C.

_____. 1968. Soil Survey, Davis-Weber Area, Utah. USDA, Soil Conservation Service, Washington, D.C.

U.S.E.P.A. 1975. Methods of Quickly Vegetating Soils of Low Productivity, Construction Activities. EPA-440/9-75-006. U.S. E.P.A. Washington, D.C.

Viertel, A. T. 1970. Trees, Shrubs, and Vines. Syracuse University Press, Syracuse, New York.

Wilson, C. L.; Loomis, W. E.; and Steeves, T. A. 1971. Botany. Holt, Rinehart, and Winston, New York.

Wyman, D. 1965. Trees for American Gardens. McMillan, New York, New York.

_____. 1949. Shrubs and Vines for American Gardens. McMillan, New York, New York.

Correspondence and Interviews

Arizona Department of Transportation. 1976. Personal letter, Leroy E. Brady, Manager, Roadside Development Service. July 9.

Harrison, Bertrand F. 1977. Personal interview. Provo, Utah. April 5.

New Mexico State Highway Department. 1976. Personal letter. R. L. Brammer, Principal Landscape Architect. July 12, 1976.

Palmer, Jonathan. 1977. Personal interview. Salt Lake City, Utah. April 20.

Schumers, Darril. 1977. Personal interview. Ogden, Utah. March 3.

State of Idaho, Transportation Department. 1976. Personal letter. J. E. Rinard, Highway Agronomist. July 22, 1976.

State of Nevada, Department of Highways. 1976. Personal letter. Laurnal H. Gubler, Superviser, Roadside Development and Environmental Services, August 9, 1976.

Thurgood, Larry. 1977. Personal interview. Ogden, Utah. February 8.

Wyoming State Highway Department. 1976. Personal letter. Jon A. Sims, Landscape Designer. July 2, 1976.

APPENDIX A

This appendix contains a questionnaire letter sent to highway officials in neighboring states of Nevada, Arizona, Idaho, Wyoming, and New Mexico and their response.

1559 Atkin Avenue
Salt Lake City, Utah 84106
July 28, 1976

Gentlemen:

I am an employee for the Utah Department of Transportation, Structure Division and also a Master's Degree Candidate in Landscape Architecture at Utah State University. At the present time I am compiling information for my thesis, which will be a comparative analysis of selective indigenous/non-indigenous plant materials as utilized for highway landscaping in Utah.

The plant materials presently being used for planting designs for Utah highways are mainly non-indigenous species. At present, native plant materials have not been fully utilized in their designs. The purpose of this thesis will be to compile a list of potential native plants which can be used in future design schemes, instead of the non-indigenous species presently being used.

I would appreciate any information or literature your department has pertaining to the use of indigenous plant materials for highway planting in your state. More specifically, I would like to know the following:

1. Has your Department of Transportation utilized native species for highway planting?

2. Has there been any testing done to determine which native species survived best in the highway environment?

3. If there has been testing, what were the results?

4. To what extent are native plants irrigated along the highway?

5. What species have been determined to be the best for highway planting?

6. Do you use seedlings or seed for the purpose of highway revegetation?

7. Have there been any problems from the use of native species for highway planting?

Thank you for your time concerning this matter.

Sincerely,

Richard L. Carlson

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS
CARSON CITY, NEVADA 89712

GRANT BASTIAN
STATE HIGHWAY ENGINEER

August 9, 1976

IN REPLY REFER TO

Landscape - General

Mr. Richard L. Carlson
1559 Atkin Avenue
Salt Lake City, Utah 84106

Dear Mr. Carlson:

In reply to your request for information on our use of indigenous plant materials in landscaping our highway rights of way, I am sorry to report that we cannot be of much help.

Because of our very low annual precipitation and the lack of a commercial source of native plant material, we have planted only grasses for erosion control on our open roadway sites. The only experimental planting of any extent has been in the Lake Tahoe Basin in conjunction with the Soil Conservation Service.

In urban areas where irrigation is available, we do not feel that native plants are the best choice.

Very truly yours,

Laurnal H. Gubler, Supv.,
Rdside Dev. & Environ. Services

LHG:JS:ko

ARIZONA DEPARTMENT OF TRANSPORTATION

HIGHWAYS DIVISION

206 South Seventeenth Avenue Phoenix, Arizona 85007

RAUL H. CASTRO
Governor

WILLIAM A. ORDWAY
Director

Roadside Development Services

WILLIAM N. PRICE
State Engineer

July 9, 1976

Mr. Richard L. Carlson
1559 Atkin Avenue
Salt Lake City, Utah 84106

Re: Landscape Architecture

Dear Mr. Carlson:

Your letter of June 28, requesting information about Arizona's use of indigeneous plant material was forwarded to this service for answering.

We have, and still do, use indigeneous plants in our highway landscaping. We give more consideration, however, to each plant's performance rather than to its origin.

We find that indigeneous plants require as much or more maintenance as introduced ones.

Enclosed is a list of the major plants that we use. Those which are native to Arizona are so indicated.

I trust this is the information you seek. If not, please do not hesitate to ask for specific information.

Good luck on your thesis.

Sincerely,

WM. N. PRICE
State Engineer

E. LeRoy Brady

E. LEROY BRADY, Manager
Roadside Development Services

ELB:MM:ee

Enclosure

NEW MEXICO
STATE HIGHWAY DEPARTMENT

JAMES A. BIRD
STATE HIGHWAY ENGINEER

P. O. Box 1149
SANTA FE, NEW MEXICO
87503

July 12, 1976

Mr. Richard L. Carlson
1559 Atkin Avenue
Salt Lake City, Utah 84106

Dear Mr. Carlson:

In reference to your inquiry as to the use of indigenous plant species being utilized in landscape plantings accomplished by the Highway Department, I offer the following information.

In 1965 the Department entered into a cooperative agreement with the Soil Conservation Service for the purpose of developing plant species selections, and evaluation of these plants for adaptability, growth characteristics, propagation methods, and establishment techniques. Through this effort we have utilized thousands of "native" plants in both dry land and irrigated plantings.

The results of the survival percentage when accounted with the low level of establishment maintenance reveals we would easily be into the eighty percentage (if you discounted the loss through destruction by mowers, theft, fire, and misguided blade work). If the level of maintenance were of the same intensity as required with the use of typical "non-indigenous" species, the "native" species would rate in the ninety to one hundred percentage survival and the "non-indigenous" would be in the low seventy percentage which is average for the nation on roadside plantings.

The lower level of establishment and maintenance expenditures make these plants a real attribute in an area that is so dependent upon its water resources. There are at present several cities and agencies that are expending their maintenance budget for the most part simply on water bills that could provide more plantings of a very high quality through the use of native plants.

We have participated in the release of "Pink Lady" winterberry euonymus and "Bandera" Rocky Mountain penstemon. We are working on the release of desert willow, skunkbush sumac, mountain mahogany, New Mexico forestiera, Apache plume, soaptree yucca, a Russian olive, a clematis, and a low-growing three-leaf sumac. It is hard to get the idea across to the Variety Release Committee that there is a need for these plants, not only in the agency work, but in the public use.

If I can be of further help, please feel free to inquire.

Very truly yours,

JAMES A. BIRD
State Highway Engineer

By: R. L. Brammer
R. L. Brammer
Principal Landscape Architect

RLB:jdm

THE STATE OF WYOMING

Ed Herschler, *Governor*
W. G. Lucas, *Superintendent and Chief Engineer*

Wyoming State Highway Department

P. O. BOX 1708 CHEYENNE, WYOMING 82001

July 2, 1976

Mr. Richard L. Carlson
Utah Department of Transportation
1559 Atkin Ave.
Salt Lake City, UT 84106

Landscaping, General

Dear Mr. Carlson:

The Wyoming Highway Department uses mostly grasses for revegetation work. Most of these grasses are indigenous to Wyoming. Some of the indigenous types are Western Wheatgrass, Blue Grama, Indian Ricegrass, Timothy, Redtop, Red Fescue, Big Bluegrass, Bromegrass, Green Needlegrass, Crested Wheatgrass, Thickspike Wheatgrass, Tall Wheatgrass, Streambank Quackgrass, Bluebunch Wheatgrass, Slender Wheatgrass, Buffalograss, Prairie Sandreed, Alkali sacaton, Sand dropseed and Little Bluestem.

Many of the above grasses were originally introduced from Europe and Asia many years ago. I like to think of them as indigenous to many parts of Wyoming because they do spread and continue to persist in non-cultivated areas. Your concept of indigenous may be different than mine.

The problems that one encounters when using small shrubs and forbs for revegetation work, whether indigenous or not, are those of inadequate seed suppliers and inadequate germination qualities of seeds purchased. Special seed treatments, such as acid baths and mechanical scarification are needed to insure that seeds of many saltbushes and sagebrushes will germinate.

Many of the small shrubs, such as Rabbitbrush and Sagebrush are considered noxious species by many of the ranchers who like to cut hay in the Highway right-of-ways.

Wyoming does have many areas, however, such as the Rocksprings area, where it is very difficult to grow even grasses. Some shrub planting, with four-wing saltbush, was tried, but because the seed had a very low germination percentage, little of the saltbush actually camp up.

Mr. Richard L. Carlson
Utah Department of Transportation
July 2, 1976
Page II

Northplan Seed Producer's, Box 9107, Moscow, Idaho 83843, is now offering many indigenous shrub and forb species seeds. Amoung them are Yarrow, Lead Plant, Balsam root, Mule's-ears, Manzanita, Sagebrush, 4-wing Saltbrush, shadscale, Antelope bitterbrush, Skunkbush sumac, Wood's rose, Elder, Snowberry, Rabbitbrush, and many of the tree species that are native to the Rocky Mountains.

I am sure that the Wyoming Highway Department will be planning to test some of the forbs and shrubs such as those I have listed, however, we have done very little of this in the past. The use of indigenous grass species, that is, those that were considered natives before all of the introduced species cam along, has been very little. Here again, many of these species have low germination factors and are not readily available from seed suppliers.

Most of our seeding is drill seeding, and special drills, that seeding contractors do not have, are required to seed them.

For hydraulic seeding or broadcast seeding, however, most any type of seed can be used. We have found, though, that drill seeding produces the best results, and stick with it where we can.

I hope this letter will help in your investigation of indigenous species that could be used for revegetation work.

Very truly yours,

Jon A. Sims

Jon A. Sims
Landscape Designer

JAS:kmj

STATE OF IDAHO
TRANSPORTATION DEPARTMENT BOX 7129 BOISE, IDAHO 83707

July 22, 1976

Mr. Richard L. Carlson
1559 Atkin Avenue
Salt Lake City, Utah 84106

Dear Mr. Carlson:

Your letter of June 28 addressed to Mr. Manning has been referred to this office for reply.

Enclosed are three items of printed material used by the Idaho Division of Highways that may be of value to you.

We have used native seed in our mixes beginning with Rabbitbrush in 1970. The species shown on the Southern and Northern collection lists are all referred to as 'natives' for simplicity. You can pick out those that are truly indigenous. All of these have not been available. Those checked have been purchased and used, some in rather small quantities. Those marked with an asterix have given some results--the most successful are underlined.

We are pleased with our program at this time and are learning new things about the natives each year. I think there is a real risk of over-doing the effort; for this reason, we salt and pepper the seeds into the mix where desired and beneficial. Besides, it can get expensive with the average cost per lb. of native seeds last year being $11.00.

I trust this information will be of use to you.

Very truly yours,

J. E. RINARD
Highway Agronomist

pb
Enc.

APPENDIX B

This appendix contains plant characteristics and adaptions for formulating the native plant list.

Introduction

The following information was generated to describe the characteristics and adaptions of individual species on the plant form. This information was divided into five categories for the users convenience.

Description

Scientific and Common Name. The botanical or Latin name for each species was given because it serves as the most accurate and consistent nomenclature for identifying or classifying the species. To the right is the common name or most frequently used common name. Arthur H. Holmgren and James T. Releal's book, Checklist of the Vascular Plants of the Intermountain Region was used as the main source of information pertaining to the correct name and spelling of each specie. For the purposes of this study the author of the scientific name was not included as part of the scientific name.

Ultimate Height and Ultimate Spread. Ultimate height and spread is the maximum height and spread a plant may obtain under ideal growing conditions. The mature height and spread could be less due to the quality of the site. Height and spread of the plant is given in feet and meters.

Form. Form is the description of the natural shape and growth habits of the plant. To achieve proper grouping and spacing, it is important to have information pertaining to form characteristics. The

shape of the plant can be rounded, arching, irregular, pyramidal or prostrate.

Texture. The texture is determined by the size of leaves or leaflets on deciduous plants and cluster or needle size on evergreen plants. The following criteria for determining texture was taken from a thesis by Richard K. Sutton (1974). They are as follows:

0.0" (0 cm) to 1.5" (4 cm) = Fine texture

1.5" (4 cm) to 3.0" (7.5 cm) = Medium texture

3.0" (7.5 cm) + = Coarse texture

Twigs. Twigs are the small shoots or branchlets of the plant, and are described by shape, size and color.

Bark. Bark is the protective outer cover of the plant and is described by texture, form, thickness and color, and is a means of plant identification.

Leaf Description. Leaves are described by shape, size, margin, type and texture, and are a means of plant identification.

Leaf Color. Leaf color is one of the most noticeable characteristics of the plant. Leaf color is given for both summer and autumn.

Flower Color. Flower color is the color of the flower, and tells if the flower is inconspicuous or not.

Flower Time. Flower time is the season of the year when the plant is in bloom.

Fruit. The fruit is described by color, form, size and type.

Root Type. Root type is the form or type of root system the plant develops underground; it is described as a vertical taproot, lateral spreading or fibrous.

Life Span. The following life span data was taken from Sutton (1974) and is approximate only. They are as follows:

1 to 80 years = short

80 to 200 years = moderate

200 to 400 years = long

400 years and up = very long

Poisonous. Poisonous is a notification that the plant has possible poisonous effects for people or animals. This obnoxious nature makes it necessary to weigh the value of the plant against its possible poisonous effects. In most cases, if the poisonous species is planted in combination with a nonpoisonous species, animals will forge on both species and therefore will not suffer.

Use

Best Use. Best use refers to what the plant is best suited for. It tells if the plant can be used for erosion control, ornamental use or if it has any commercial importance.

Palatability. Palatability notes what animals or birds, wild or domestic may browse or forage on the plant. Animals on the highway are potential hazard for vehicular traffic; any species should be evaluated before it is used.

Adaptations

Elevation and Topography. Each plant has an elevation range which it will survive in. The elevations shown are given in feet above sea level. Topography is the description of the area where the plant will exist.

Range Sites. Range site designates in which region of Utah the plant will exist.

Exposure. A plant has a basic need for sun or shade for it to survive and reproduce. Exposure refers to whether the plant needs sun or shade.

Drought Tolerance. Drought tolerance is the ability of the plant to withstand dry conditions.

Wind Firm. Wind firm notes if the root system is adequate enough to hold the plant in a strong wind.

Aspect. Aspect is the orientation of the ground or slope relative to north on which the plant is normally found or prefers to grow.

Soil. Soil is a broad heading which is comprised of several properties such as texture, pH, depth, moisture, organic matter and drainage.

Texture is the relative amount of rock, gravel, sand silt/loam or clay that constitutes the soil. It is referred to as rocky, coarse, medium or fine.

The pH is the chemical makeup of the soil and is measured on a scale from 0 for extremely acid soils to 14 for extremely alkaline soil, with 7 as the neutral point.

Depth refers to the potential root system of the plant in relationship to the soil depth, and are given as follows:

0" (0 cm) to 12" (30 cm)	= Shallow
12" (30 cm) to 30" (76 cm)	= Moderate
30" (76 cm) and deeper	= Deep

Moisture notes if the plant needs dry or moist soil conditions for the plant to maintain itself.

Organic matter refers to whether the plant needs organic matter in the soil in order to grow.

Drainage notes if the plant tolerates moist or well drained soils.

Establishment

Transplantability. Transplantability refers to whether a plant can be moved successfully from one place to another.

Planting Time. Planting time refers to the time of year or season when it is best to plant to insure maximum survival.

Management

Maintenance. Maintenance notes if the plant is carefree and clean or if it will require a specific type of maintenance.

Insects. Insects notes the number of known insects found on the genus or species. This indicates how susceptible the plant is to insects.

Diseases. Diseases notes the number of organisms which are known to occur on the specie. In some cases, the species is an alternate host for disease or insects.

It should be noted that information pertaining to insects and diseases was taken from Stark (1966) a publication compiled for Nevada Highways. For this reason, a species should not necessarily be eliminated from consideration for highway planting in Utah because of the number of insects shown on the plant form. It is possible that some of these insects do not exist in Utah or may only be mildly damaging to the species, while others may be beneficial.

APPENDIX C

This appendix contains a matrix summarizing the pertinent information for each species of trees, shrubs and ground cover.

GROUND COVER/VINE

Page Number	SCIENTIFIC NAME / COMMON NAME	DESCRIPTION						USE		ESTABLISHMENT											ADAPTATION		MANAGEMENT		
															Soil										
		Height	Spread	Form	Texture	Root Type	Poisonous	Use	Palatability Appeals to	Elevation	Exposure	Drought Tolerance	Wind Firm	Aspect	Texture	pH	Depth	Moisture	Drainage		Transplant-ability	Planting Time	Number of Known Insects	Number of Known Diseases	Climate Zone
90	Berberis repens Creeping Barberry	1 6	4 6	prostrate	medium	spread	no	ground cover	wildlife birds	5,500 10,000	shade sun	good	good	all	medium coarse	5.5 7.0	shallow mod.	dry moist	W/D		good	INA	0	4	2 3
92	Ceanothus prostratus Squaw Carpet	3 8	10	prostrate	medium	INA	no	ground cover	wildlife	3,000 6,500	sun	INA	INA	NE.	medium coarse	INA	INA	mod.	W/D		INA	INA	0	30	2
100	Clematis ligusticifolia Western Virgin's Bower	12 18	12 18	spreading vine	medium	shallow	no	ground cover	wildlife birds	below 7,000	sun	poor	poor	str.	medium coarse	7.0	shallow deep	moist	W/D		good	INA	3	39	2
106	Eriogonum caespitosum Matted Buckwheat	3" 6"	2	matted	fine	tap root	no	ground cover	wildlife birds	5,000 8,600	sun	good	good	all	fine coarse	7.0	shallow mod.	dry	W/D		poor	spring	1	14	2
107	Eriogonum umbellatum Sulphur-flowered Buckwheat	4" 10"	2 3	matted	fine medium	fibrous	no	ground cover	wildlife birds	5,600 10,500	sun	good	good	all	fine coarse	7.0	mod.	dry	W/D		poor	INA	1	14	2 3

Legend

* - May be shrubby in form
INA - Information not available
W/D - Well-drained
grp - Good if in pure stand
str. - Streams
S - South
E - East
W - West
N - North

EVERGREEN SHRUBS

Page Number	SCIENTIFIC NAME / COMMON NAME	DESCRIPTION						USE		ESTABLISHMENT											ADAPTATION		MANAGEMENT		
															Soil										
		Height	Spread	Form	Texture	Root Type	Poisonous	Use	Palatability / Appeals to	Elevation	Exposure	Drought Tolerance	Wind Firm	Aspect	Texture	pH	Depth	Moisture	Drainage		Transplant-ability	Planting Time	Number of Known Insects	Number of Known Diseases	Climate Zone
81	Arctostaphylos patula Greenleaf Manzanita	6	10	rounded symmetrical	fine medium	deep	no	erosion control	wildlife birds	2,000 9,000	sun	good	good	S.	coarse	5.0 6.0	moder.	med.	W/D		poor	spring	25	5	1 2
82	Artemisia filifolia Sand Sagebrush	1 4	INA	rounded	fine	INA	no	erosion control	none	3,000 5,000	sun	good	INA	INA	sandy coarse	INA	INA	dry	W/D		INA	INA	INA	INA	1 2
83	Artemisia frigida Fringed Sagebrush	4" 14"	12"	matted	fine	fibrous	no	erosion control	wildlife livestock	4,500 10,000	sun	mod. good	good	all	fine coarse	7.0	shallow deep	dry	W/D		good	spring	21	2	2 3
84	Artemisia nova Black Sagebrush	4" 16"	11" 21"	spreading	fine	deep spread	no	ornament	wildlife livestock	4,000 8,000	sun	good	good	all	coarse	6.5 7.5	shallow	dry	W/D		good	spring	9	30	2
85	Artemisia tridentata Big Sagebrush	3' 12	5 8	rounded	fine	deep spread	no	erosion control	wildlife	1,500 10,600	sun	good	good	all	fine coarse	6.5 7.5	moder. deep	dry	W/D		good	spring	9	33	2 3
86	Atriplex canescens Fourwing Saltbrush	2 6	INA	spreading	fine	deep spread	yes	erosion control	wildlife livestock	below 7,000	sun	good	good	INA	fine	INA	deep	dry	INA		poor	spring	0	14	2
87	Atriplex confertifolia Shadscale	3	4	rounded	fine	deep spread	no	low screen	wildlife livestock	below 7,000	sun	good	good	all	fine medium	7.5 9.0	moder. deep	dry	W/D		good	spring	11	14	2
88	Atriplex nuttallii Nuttall Saltbrush	3	3	rounded	medium	deep spread	yes	shrub	wildlife birds	4,000 5,000	sun	good	good	all	medium coarse	7.5 8.5	moder.	dry	W/D		good	spring	11	14	2
89	Berberis fremontii Fremont Mahonia	3	INA	erect	medium	INA	no	INA	wildlife	3,000 5,000	sun	good	INA	N.	coarse	INA	INA	dry	W/D		INA	INA	3	0	1 2
98	Chrysothamnus nauseosus Rubber Rabbitbrush	2 3	2 3	rounded	fine	deep	no	ornament	none	3,000 8,000	sun	good	good	all	fine medium	7.0 8.5	moder.	dry	W/D		poor	autumn	0	20	1 2
99	Chrysothamnus viscidiflorus Douglas Rabbitbrush	1 3	2 3	rounded erect	fine	deep	no	ornament shrub	wildlife	5,000 10,000	sun	good	good	all	fine medium	7.0	deep	dry	W/D		poor	INA	0	20	2
102	Cowania stansburiana Stansbury's Cliffrose	3 10	3 8	irregular	fine medium	deep spread	no	ornament shrub	wildlife livestock	3,500 8,000	sun	good	good	all	fine coarse	7.0 8.0	deep	dry	W/D		good	fall	0	1	2
104	Ephedra nevadensis Nevada Mormon Tea	1 5	10	spreading	coarse	INA	no	erosion control	wildlife	below 4,500	sun	good	good	INA	coarse	INA	INA	dry	W/D		good	spring	0	4	1 2
105	Ephedra viridis Green Mormon Tea	1 5	10	erect	coarse	INA	no	erosion control	wildlife	3,000 7,500	sun	good	good	INA	coarse	INA	INA	dry	W/D		good	spring	0	4	1 2
110	Juniperus communis Mt. Common Juniper	3	8 10	ascending spread	fine	fibrous spread	no	erosion control	wildlife birds	5,000 7,000	shade sun	good	good	NE	fine coarse	7.0	deep	dry moist	W/D		poor	spring	10	10	2
113	Larrea divaricata Spreading Creasotebush	4 8	INA	irregular	fine	INA	no	screen	INA	below 5,000	sun	good	good	S	INA	INA	INA	dry	W/D		good	spring	0	2	1
127	Purshia tridentata Antelope Bitterbrush	9	3 4	irregular	fine	fibrous spread	no	erosion control	wildlife livestock	4,000 8,000	sun	good	good	SE	fine coarse	6.0 7.0	mod. deep	dry	W/D		poor	spring	0	0	2
130	Quercus turbinella Shrub Live Oak	5 9	INA	irregular	fine	INA	yes	INA	wildlife	3,500 6,000	sun	good	good	INA	medium coarse	INA	INA	dry	W/D		poor	spring	0	0	1
152	Yucca baccata Spanish Bayonet	1	INA	erect	coarse	tap root	no	ornament	wildlife	3,000 4,000	sun	good	good	SW	medium	INA	INA	dry	W/D		INA	spring	9	17	1
153	Yucca brevifolia Joshua Tree Yucca	13	INA	grotesque	coarse	INA	no	ornament	none	2,000 3,500	sun	good	good	all	fine medium	INA	deep	dry	W/D		good	autumn	9	14	1

DECIDUOUS SHRUBS

Page Number	SCIENTIFIC NAME / COMMON NAME	DESCRIPTION						USE		ESTABLISHMENT											ADAPTATION		MANAGEMENT		
															Soil										
		Height	Spread	Form	Texture	Root Type	Poisonous	Use	Palatability Appeals to	Elevation	Exposure	Drought Tolerance	Wind Firm	Aspect	Texture	pH	Depth	Moisture	Drainage		Transplant-ability	Planting Time	Number of Known Insects	Number of Known Diseases	Climate Zone
101	Cornus stolonifera Redosier Dogwood	7 8	20	clump spreading	medium	spread	no	mass shrub	birds	9,000 below	sun shade	poor	good	str.	medium coarse	7.0 8.0	mod.	moist wet	W/D		good	fall	11	10	2 3
123	Potentilla fruticosa Shrubby Cinquefoil	4	2	rounded	fine	fibrous spread	no	erosion control	wildlife	6,500 12,000	sun shade	poor	good	all	fine medium	6.5 7.0	shallow	moist	W/D		good	spring	1	3	2 3
131	Rhus glabra Smooth Sumac	6 7	5 9	erect	medium coarse	shallow	no	ornament	wildlife birds	4,500 7,000	sun	good	good	S.	coarse	6.5 7.0	shallow moder.	dry moist	W/D		good	INA	14	14	2
132	Rhus trilobata Skunk Brush	1 6	10	rounded spreading	fine medium	fibrous spread	no	erosion control	birds	3,000 9,000	shade sun	good	good	S.	medium coarse	6.5 7.5	deep	dry	W/D		good	spring	14	7	2 3
133	Ribes aureum Golden Currant	4	4	rounded	fine medium	shallow spread	no	erosion control	wildlife birds	4,000 10,000	shade sun	mod.	good	all	medium coarse	6.5 7.0	shallow deep	dry moist	W/D		good	spring	7	23	2 3
134	Robinia neomexicana New Mexico Locust	6 25	INA	irregular	fine	INA	no	erosion control	wildlife livestock	4,000 8,500	sun	good	good	NA	INA	INA	deep	dry	W/D		INA	spring	9	7	2
135	Rosa woodsii Wood's Rose	1 9	6 9	arching	medium	shallow spread	no	erosion control	wildlife birds	8,500 9,000	sun	mod.	poor	all	medium coarse	6.0	shallow deep	moist dry	W/D		good	INA	15	37	3
143	Salix wolfii Wolfs Willow	3	3 4	rounded	fine medium	fibrous spread	no	stream erosion	wildlife livestock	4,000 9,000	sun	poor	good	all	medium	6.5 7.0	moder.	moist wet	wet		good	spring	91	many	2 3
144	Sambucus caerulea Blueberry Elderberry	6 18	5 8	vase	medium coarse	fibrous spread	yes	erosion control	wildlife	5,500 8,000	sun	poor	good	all	medium coarse	7.0	deep	moist dry	W/D		good	INA	2	10	2
145	Sambucus microbotrys Elderberry	12	5 6	irregular	medium coarse	fibrous spread	yes	erosion control	wildlife livestock	6,000 11,000	shade sun	poor	good	all	medium coarse	7.0	moder.	moist	W/D		good	spring	3	7	2 3
146	Sarcobatus vermiculatus Greasewood	3 8	INA	rounded erect	fine	INA	yes	ornament	wildlife	3,000 7,000	sun	good	INA	INA	fine coarse	8.0	NA	dry	INA		good	spring	8	0	2
147	Shepherdia argentea Silver Buffaloberry	6 21	10	irregular	medium	suck-ering	no	erosion control	INA	4,500 7,500	sun	poor	good	all	medium coarse	7.0 8.0	deep	moist	W/D		good	INA	1	13	2
148	Sorbus scopulina Greene's Mountain Ash	12	5	irregular	medium	spread	no	ornament	wildlife livestock	6,000 10,000	shade sun	poor	good	all	medium coarse	6.0 7.0	deep	moist	W/D		good	spring	16	48	2 3
149	Symphoricarpos longiflorus Longflower Snowberry	1 2	3	spreading	fine	fibrous spread	no	erosion control	birds	4,500 7,000	sun	mod.	good	all	medium coarse	7.0 8.0	moder. deep	dry	W/D		good	spring	11	0	2
150	Symphoricarpos oreophilus Western Snowberry	3	3	rounded	fine	fibrous	no	erosion control	wildlife birds	6,300 9,000	sun	mod.	good	all	medium	7.0	moder.	moist	W/D		good	spring	11	7	2
151	Tetradymia canescens inermis Gray Horsebush	1 3	INA	irregular	fine	INA	yes	erosion control	wildlife	4,000 8,000	sun	good	INA	INA	INA	INA	INA	dry	W/D		INA	spring	0	0	2

EVERGREEN TREES

Page Number	SCIENTIFIC NAME / COMMON NAME	DESCRIPTION						USE		ESTABLISHMENT											ADAPTATION		MANAGEMENT		
															Soil										
		Height	Spread	Form	Texture	Root Type	Poisonous	Use	Palatability Appeals to	Elevation	Exposure	Drought Tolerance	Wind Firm	Aspect	Texture	pH	Depth	Moisture	Drainage		Transplant-ability	Planting Time	Number of Known Insects	Number of Known Diseases	Climate Zone
73	Abies concolor White Fir	100' 120'	25' 30'	pyramidal	medium	fibrous spread	no	erosion control	wildlife	5,000 10,000	shade sun	mod. good	good grp.	N. N.W.	medium	5.5 7.0	deep	moist	W/D		young	spring	19	24	3
74	Abies lasiocarpa Subalpine Fir	80' 90'	21' 27'	pyramidal spirelike	medium	spread	no	erosion control	wildlife livestock	4,600 11,000	shade sun	poor	good grp.	N.	medium coarse	5.5 7.0	deep	moist	W/D		young	spring	6	many	3
95	Cercocarpus ledifolius * Curlyleaf Mountain Mahogany	12'	15'	irregular	fine	shallow Spread	no	ornament shrub	wildlife	5,000 9,000	sun	good	good	S.	coarse	6.0 7.0	deep shallow	dry	W/D		poor	late autumn	none	9	2 3
96	Cercocarpus montanus * True Mountain Mahogany	3' 10	6'	irregular	fine	deep spread	no	ornament shrub	wildlife	4,000 9,500	sun	mod. good	good	all	coarse	6.5 7.5	deep	dry	W/D		poor	INA	4	9	2 3
111	Juniperus osteosperma Utah Juniper	8 15	15 18	dense rounded	medium	fibrous spread	no	windbreak	wildlife birds	4,000 7,500	sun	good	good	all	fine coarse	7.0 8.0	deep	dry	W/D		young	spring	10	10	2
112	Juniperus scopulorum Rocky Mountain Juniper	20 50	25	pyramidal symmetrical	fine	fibrous spread	no	windbreak	wildlife birds	5,000 9,000	sun	good	good	all	fine coarse	7.0 8.0	shallow mod.	dry moist	W/D		young	spring	1	10	2 3
114	Picea engelmannii Engelmann Spruce	100	30 35	pyramidal	medium	shallow spread	no	windbreak	wildlife birds	7,000 +	sun	poor	good grp.	N.	medium	6.0 7.0	mod. deep	moist	W/D		young	spring	13	74	3
115	Picea pungens Blue Spruce	90	25 30	pyramidal	fine medium	wide spread	no	windbreak	wildlife birds	6,500 8,000	sun	poor	good grp.	N.	medium	7.0	mod.	moist	W/D		young	spring	13	74	3
116	Pinus edulis Pinyon Pine	15 35	15	rounded bushy	medium	exten-sive	no	windbreak	wildlife birds	5,000 7,000	sun	good	good	all	coarse	7.0 7.5	deep shallow	dry	W/D		young	spring	2	9	2
117	Pinus flexilis Limber Pine	30 45	25 30	rounded	medium coarse	tap root	no	windbreak	wildlife birds	4,000 11,000	sun	mod. good	good	all	coarse	6.5 7.0	shallow mod.	dry	W/D		young	spring	2	15	2 3
118	Pinus monophylla Singleleaf Pinyon	20	20	symmetri-cal	medium coarse	fibrous spread	no	windbreak	wildlife birds	4,500 6,500	sun	good	good	all	medium coarse	6.0 7.0	shallow deep	dry	W/D		young	spring	many	5	2
119	Pinus ponderosa Ponderosa Pine	150	20 30	symmetrical round-top	medium	tap root	yes	windbreak	wildlife birds	5,000 8,000	shade sun	good	good	SW.	medium coarse	6.5 7.0	deep	moist	W/D		young	spring	45	55	3
126	Pseudotsuga menziesii Douglas Fir	130	25 30	pyramidal symmetrical	fine medium	lateral spread	no	windbreak	wildlife birds	5,000 8,000	shade sun	good	good grp	N.	medium coarse	6.0 7.0	deep	moist	W/D		young	INA	5	61	3
128	Quercus chrysolepis * Palmer Oak	6 25	INA	dense broad crown	medium	INA	yes	erosion control	wildlife	3,000 7,000	sun	good	good	INA	medium coarse	N.A.	N.A.	dry	W/D		poor	autumn	76	many	1

DECIDUOUS TREES

Page Number	SCIENTIFIC NAME / COMMON NAME	DESCRIPTION						USE		ESTABLISHMENT											ADAPTATION		MANAGEMENT		
														Soil											
		Height	Spread	Form	Texture	Root Type	Poisonous	Use	Palatability / Appeals to	Elevation	Exposure	Drought Tolerance	Wind Firm	Aspect	Texture	pH	Depth	Moisture	Drainage		Transplant-ability	Planting Time	Number of Known Insects	Number of Known Diseases	Climate Zone
75	Acer glabrum * Rocky Mountain Maple	25	15	rounded	medium	fibrous spread	no	ornament shrub	wildlife	6,000 9,000	shade sun	poor fair	good	N.	medium coarse	6.0 7.0	deep	moist dry	W/D		poor	spring	49	7	3
76	Acer grandidentatum * Bigtooth Maple	30 40	25	rounded spreading	medium coarse	shallow spread	no	ornament shrub	wildlife	4,500 7,500	sun	fair good	good	all	medium coarse	6.0 8.0	shallow deep	moist dry	W/D		poor	INA	49	8	3
77	Acer negundo Boxelder	65	25 30	irregular	medium	spread	no	shade	wildlife birds	4,000 8,000	sun	good	good	all str.	medium coarse	6.5 7.5	deep	moist dry	W/D		good	fall	49	32	2 3
78	Alnus tenuifolia * Thinleaf Alder	30	15	rounded	medium	shallow fibrous	no	stream erosion	wildlife livestock	5,000 8,500	shade sun	poor	good	N.W.	medium	6.0 7.0	deep	moist wet	W/D		good	INA	3	27	3
79	Amelanchier alnifolia * Saskatoon Serviceberry	18 21	10 15	open	fine medium	deep spread	no	ornament shrub	wildlife livestock	4,000 8,000	sun	mod.	good	SW,	medium	6.0 7.0	deep	moist	W/D		poor	INA	2	48	2
80	Amelanchier utahensis * Serviceberry	9 12	10 15	rounded	medium	deep spread	no	ornament shrub	wildlife birds	4,000 8,000	sun	good	good	SW,	medium coarse	6.5	mod.	dry	W/D		poor	spring	2	48	2 3
91	Betula occidentalis * River Birch	30	10 15	rounded	medium	shallow fibrous	no	stream erosion	wildlife livestock	5,000 8,000	sun	good	good	str.	medium	6.5 7.0	shallow	moist wet	W/D		good	spring	20	0	2 3
93	Celtis reticulata Netleaf Hackberry	30	INA	rounded	medium	INA	no	INA	wildlife birds	2,000 6,000	sun	good	good	INA	medium coarse	INA	INA	moist	W/D		INA	spring	6	62	1
94	Cercis occidentalis California Redbud	6 20	INA	rounded	medium	INA	no	ornament	none	5,000 6,000	sun	good	good	INA	fine medium	INA	INA	dry moist	W/D		INA	INA	9	4	1
97	Chilopsis linearis * Desertwillow	6 25	INA	broad	fine	INA	no	erosion control	none	1,000 5,000	sun	good	good	INA	medium coarse	INA	INA	moist	W/D		INA	fall	INA	4	1
103	Crataegus rivularis River Hawthorn	20	15 20	rounded thicket	medium	tap root	no	stream erosion	birds	5,000 6,000	sun	good	good	str.	medium	7.0	deep	moist	W/D		poor	INA	30	7	2
108	Fraxinus anomala Singleleaf Ash	6 23	INA	rounded spreading	fine medium	INA	no	ornament	livestock	2,500 6,000	sun	good	good	all	medium	INA	INA	moist	W/D		good	INA	30	70	1
109	Fraxinus velutina Velvet Ash	30 40	INA	rounded crown	medium	INA	no	ornament	none	2,500 7,000	sun	good	good	INA	INA	INA	deep	moist	W/D		INA	INA	5	6	1
120	Populus angustifolia Narrowleaf Cottonwood	45 60	30 40	irregular	medium	shallow fibrous	no	erosion control	wildlife	4,000 8,000	sun	poor	poor	str.	medium coarse	7.0	deep	moist	W/D		good	spring	12	27	2 3
121	Populus fremontii Fremont Cottonwood	70	70	broad crown	medium	Fibrous spread	no	erosion control	wildlife	6,000 below	sun	poor	poor	str.	medium coarse	6.5 7.5	deep	moist	W/D		good	spring	12	14	1
122	Populus tremuloides Quaking Aspen	18 40	25 30	pyramidal	medium	spread	no	ornament erosion control	wildlife livestock	6,000 10,000	sun	poor	good	all	medium coarse	6.5 7.0	deep	moist dry	W/D		good	fall spring	12	25	2 3

DECIDUOUS TREES

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124	Prosopis juliflora * Mesquite	30 40	INA	spreading	fine	tap root	no	erosion control	wildlife livestock	5,000 below	sun	good	good	INA	INA	INA	deep	moist	W/D	good	spring	70	20	1
125	Prunus virginiana Western Chokecherry	30	15 20	rounded	medium	spread lateral	yes	ornament	wildlife birds	4,500 8,000	shade sun	poor	good	N.	medium coarse	7.0	mod.	moist	W/D	good	spring	67	33	2 3
129	Quercus gambelii Gambel Oak	9 15	12 15	irregular	coarse	deep spread	yes	erosion control	wildlife	4,500 9,000	sun	mod.	good	all	coarse	7.0 7.5	deep	dry	W/D	poor	fall	1	14	2
136	Salix amygdaloides Peachleaf Willow	30	INA	rounded irregular	medium	fibrous spread	no	ornament	wildlife livestock	3,000 8,000	sun	poor	good	all str.	medium	6.5 7.5	mod.	wet	wet	good	spring	INA	INA	2
137	Salix bebbiana Bebb Willow	8 9	4 5	round clump	medium	fibrous spread	no	stream erosion	wildlife livestock	7,000 12,000	sun	poor	good	all str	medium coarse	7.0	mod.	wet dry	wet	good	spring	91	many	2 3
138	Salix exigua Coyote Willow	6 12	3 5	irregular	fine	fibrous spread	no	stream erosion	wildlife	6,000 below	sun	poor	good	all str.	medium coarse	7.0 8.0	mod.	wet	wet	good	spring	91	many	2
139	Salix geyeriana Geyer Willow	9	10 15	ascending	medium	deep spread	no	stream erosion	wildlife livestock	4,000 8,000	sun	poor	good	all	medium	5.0 6.5	mod.	wet	wet	good	spring	91	many	2
140	Salix gooddingii Gooding Willow	40 45	INA	ascending	medium	deep spread	no	stream erosion	wildlife birds	4,000 5,000	sun	low med.	mod.	all str	medium	6.5 7.5	INA	wet dry	wet	good	spring	INA	INA	2
141	Salix lasiandra Pacific Willow	15 45	15	open ascending	medium	fibrous spread	no	stream erosion	wildlife birds	5,000 8,000	sun	poor	mod.	all str	medium coarse	6.0 7.0	deep	moist	W/D	good	spring	91	12	2
142	Salix scouleriana Scouler Willow	9 12	10	rounded	medium	fibrous spread	no	stream erosion	wildlife livestock	6,000 10,000	sun	poor	good	all str	medium	6.5 7.0	deep	moist dry	W/D	good	spring	91	many	2 3